KENTUCKY LANDFARM MANUAL

kentucky operator certification program

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Goal

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Introduction

This section will introduce the reader to a general outline of the **TRAINING MANUAL for LANDFARMING OPERATORS**. This manual is intended to provide some specific detail on wastes, soil properties, site selection, regulations, and landfarming operation and management. These details are supported in several areas by a more general outline and summary that should be helpful in using these details. Landfarming in general is governed by regulations because of the wastes, and of the public's concern for their environment. Therefore, it becomes important to integrate both agronomic and regulatory features that affect landfarming. Agronomic discussions are not intended to replace regulations in this manual but to supplement them. Regulations discussed in this manual were put into effect on May 8, 1990 with additions becoming effective on June 24, 1992. Consult the Division of Waste Management for regulations applying to a particular waste or landfarming practice. ***This Manual is written specifically for the state of Kentucky. On March 22, 1993, new federal rules went into effect which regulates use and disposal of sewage sludge. This rule (40 CFR 503) has certain requirements, which are not included or incorporated in Kentucky's sludge management program. If you generate, treat, dispose, incinerate, or beneficially reuse sewage sludge in Kentucky, you must comply with both state and federal rules. This manual discusses some requirements of the 503 rule, but is not intended as a complete guide.***

Purpose

This manual provides detailed and general information for landfarming Special and Solid Wastes in Kentucky. This information should be especially helpful in (1) assisting the training of landfarming operators, and (2) serving as a reference for treatment plant operators, permit writers, consultants, regulators, and others interested in landfarming. Throughout the manual both principles and practical application are stressed along with the Kentucky regulations. This manual provides relevant information, identifies available resources of information, and explains methods of evaluating information, identifies available resources of information, and explains methods of evaluating information for use in site studies and proposals. Whether someone is conducting a site evaluation, writing a permit application, reviewing a proposal or monitoring the landfarming system, a solid base of technical information is mixed with a healthy dose of common sense. The Kentucky regulations in many cases serve as the minimums for further evaluations.

This manual cannot, however, provide a complete and detailed prescription for wastes, site evaluation and system management. Because each landfarming operation represents a unique combination of wastes, soil, cropping system and monitoring, a unique set of conditions or parameters must be prepared for each system. This unique combination must be evaluated within the current regulations while considering the environment, the landfarming system and monitoring schedules.

Beneficial Reuse

Anytime a waste material is applied to the land, this is viewed as part of a recycling effort or beneficial reuse of a waste. Land application of wastes benefits agriculture, the

environment and society. Agriculture benefits as wastes improve the physical condition of the soil and supplies nutrients for crop production. The environment benefits as this reduces the concentration of nutrients handled by waste treatment facilities. Society benefits from a reduced need for landfill space and in having wastes applied in a safe and effective manner. It is suggested that all landfarming permit applications or proposals should list these benefits in addition to the importance of maintaining environmental quality and protecting the public from hazards that may be associated with any waste.

Landfarming

Landfarming is the application of wastes on or just below the surface of the land. Concurrent with improving soil productivity, landfarming also functions as a waste treatment process. Sunlight and soil microorganisms help destroy any potentially harmful pathogens remaining after primary treatment process and some toxic organic substances remaining after the primary treatment process and some toxic organic substances remaining after primary treatment. Heavy metals and, to some extent, nutrients in wastes are trapped by soil as a result of various physical and chemical properties. Nutrients are converted to useful biomass, which reduces concerns for surface and groundwater degradation.

However, the land has a limit to its capacity to treat wastes, and any landfarming system must be designed and operated to work within this capacity. If these principles are followed, it is generally expected that any additional limitations from regulations will not drastically affect the landfarming system.

Operator Certification

All landfarming facilities must operate under the supervision of a "Certified Landfarming Operator". People who desire certified landfarm operators must apply to the Cabinet, attend required training, and successfully pass an examination. The training consists of waste treatment and biology, site selection, management of the soil-crop-waste system, regulatory requirements, equipment operation and safety, monitoring, and duties of the certified operator.

Regulatory Overview

for landfarming follow two important principles: (1) to provide overall environmental safety in reducing any potential harmful effects from wastes; and (2) to maintain a consistent recognition of limits for the land to adequately process wastes. This is accomplished by having minimum requirements, establishing site evaluation and system operating requirements, and maintaining monitoring requirements for both the environment and the landfarming system.

The landfarming regulations in Kentucky are administered in the Division of Waste Management as Kentucky Administrative Regulations (KAR) that were developed in response to several sections of Chapter 224 of the Kentucky Revised Statutes (KRS) as enacted by the Kentucky Legislature.

Chapter 1: WASTE CHARACTERIZATION

Chapter 1 Objectives

1. Explain the differences between special and solid wastes.
2. Identify types of special wastes and their properties.
3. Identify types of solid wastes, their benefits or concerns in land application.

Special Waste

Special wastes are those materials of high volume and low hazard that remain after intermediate or final processing of materials by an individual, business, industry, or municipality. Special wastes are specified by KRS 224.50-760; include "mining wastes, utility wastes (fly ash, bottom ash, scrubber sludge), waste from coal gasification facilities (vitrified coarse solid residues, prilled or blocked sulfur) approved by the cabinet based on submittal of appropriate testing demonstrating that the wastes are of low hazard, sludge from water treatment facilities, sludge from wastewater treatment facilities, cement kiln dust, gas and oil drilling muds, and oil production brines". The cabinet may designate other materials special waste based on the regulatory requirements of 401 KAR 45:210.

NOTE: **Domestic septage**, the liquid and solids removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar works that receive only domestic sewage, are **NOT** special wastes. In Kentucky, domestic septage and grease trap residues are regulated by the Public Health Department in the Cabinet for Health and Family Services. Persons who wish to land apply these wastes must obtain a permit from the local Health Department and are not required to obtain Landfarming Operator certification or any permits or authorization from the Division of Waste Management.

1. Sludge – Water treatment

Water treatment sludge, also referred to as water treatment residuals, consists of the solids and associated liquids removed during production of potable water supplied to private or municipal drinking water systems. Water treatment facilities remove suspended and dissolved solids from water taken from rivers, lakes, or underground sources during the production of

potable water. Coagulants (chemicals) added for solids removal includes aluminum sulfate, ferric chloride, ferric sulfate, polymers, etc. The addition of lime may also be part of the treatment process. Water treatment solids consist of metal oxides, lime or other materials added in the treatment process, organic matter, and soil particles that precipitate or are filtered out during treatment. If handled as a liquid, the sludge is relatively low in solids. When dry, water treatment solids are very fine and subject to blowing by winds.

Since the water treatment residuals contain very low amounts of organic matter, the need for treatment to reduce pathogen levels may not be necessary. These solids contain very low levels of nutrients beneficial to crops, except calcium (Ca). Calcium precipitates out of the raw water or results from the addition of lime. When this material is land applied the calcium can be beneficial by raising soil pH. Water treatment residuals may also contain trace elements, or micronutrients, beneficial to plant growth and low levels of heavy metals (cadmium, chromium, copper, nickel, lead, and zinc) that require analysis before land application.

2. Sludge – Wastewater treatment (Biosolids)

Wastewater sludge (also known as wastewater solids or biosolids) are solids generated by the treatment of wastewater to reduce or remove biological, physical and chemical contaminants before discharging the treated wastewater.

Wastewater sludge contains from 93 – 99% liquid when initially removed from the treatment process. The makeup and contents of the incoming wastewater and the wastewater treatment processes determine the chemical and biological characteristics of sludge. The type or degree of treatment determines the classification of wastewater sludge.

a) **Primary sludge** is raw sludge obtained from the primary treatment processes. This unstable material is not suitable for land application.

b) **Secondary sludge** results from further biological treatment and stabilization within the treatment plant. This material usually has a solids content ranging from 0.5-2.0%.

c) **Activated sludge** is a secondary sludge collected from the settling tanks in a wastewater treatment plant consisting of bacterial cells, stabilized organic matter and inorganic compounds.

d) **Stabilized sludge** is a secondary sludge produced by further microbial processing (aerobic or anaerobic) or by adding chemicals to reduce odors or pathogens.

e) **Aerobic sludge** is stabilized activated sludge produced by continuously injecting air into the biological treatment process. Injected air provides oxygen to the aerobic microorganisms for digestion of organic materials in the secondary treatment process.

f) **Anaerobic sludge** is stabilized activated sludge produced by excluding air (oxygen) from the microbial process. Facilities may provide additional heat so microbes more quickly convert some of the organic material to carbon dioxide, methane and water.

g) **Chemically stabilized sludge** is sludge that results from the addition of chemicals including lime or ferric chloride during secondary sludge treatment. These chemicals decrease biological activity, reduce pathogens, reduce odors and increase percentage of solids. Chemical stabilization is a common treatment for domestic sewage.

h) **Dewatered sludge** is mechanically stabilized sludge processed to remove water, increasing the solids percentage (15-20% solids). Belt, frame and centrifuge presses are common mechanical devices used in the solids separation process.

More than 50% of wastewater sludge solids are organic matter consisting primarily of dead microbe cells and non-decomposed organic materials. These solids contain the nutrients necessary for plant growth but not in the desirable ratio needed by most plants. Sludge also contains various levels of elements classified as heavy metals or pollutants including arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, lead, selenium, and zinc, which are required to be monitored. These inorganic elements precipitate from the wastewater during treatment.

Some of the microorganisms entering the treatment plant are pathogens (disease-causing organisms). Some of these pathogens may remain in the sludge after processing. The presence of the pathogens requires a two-tier treatment process to eliminate or greatly reduce pathogens before land application.

Sludge may also contain synthetic organic chemicals generated by households and industry. Section 405(d) of the Clean Water Act requires the U.S. EPA to review existing sewage sludge regulations at least every two years (i.e., a biennial review). Through this process, "Contaminants of Emerging Concern", including Pharmaceuticals and Personal Care Products (PPCPs), flame retardants and hormone mimicking compounds such as Bisphenol A, are continuously being evaluated for possible regulation in land-applied sewage sludge.

3. Fly Ash

Fly ash is a fine material emitted into the smoke stack of coal fired boilers. These materials consist of bottom ash settled at the base of smoke stacks or ash accumulated by specially designed collectors to prevent release into the atmosphere. Fly ash properties vary greatly depending on the source and type of coal burned, and the type of ash collection system.

For example, electrostatic precipitators produce very fine material. Fly ash contains low-levels of phosphorus, potassium, calcium, magnesium, sulfur, boron, molybdenum, and other micronutrients. Depending on the original coal source and collected system, fly ash has some value for neutralizing a soils pH. Fly ash can improve moisture-holding capacity and other physical properties of sandy or gravelly soils or mine spoils.

Fresh fly ash is initially toxic to plant growth due to its content of boron, molybdenum and high pH (alkaline) from the alkali metal oxides. When exposed to moisture, these unstable metals oxides form carbonates. This requires exposure of the fly ash to the atmosphere for stabilization prior to land application. This stabilization results in a reduction of salinity and prevents toxicity to plants. Fly ash contains low levels of all the heavy metals requiring a complete analysis including total boron, molybdenum and pH before land application.

4. Lime Scrubber Sludge

Lime scrubber sludge results from the scrubbing of sulfur dioxide from the stack gases of coal-fired power plants using a liquid suspension of finely ground limestone. Holding ponds remove the excess water from the lime scrubber sludge, resulting in solids content of about 50%. Further dewatering occurs very slowly in the ponds due to the fine particle size of the material. Lime scrubber sludge requires further stabilization before land application. Stabilization processes include adding more lime, fixing agents, sodium silicate, or cement, followed by further dewatering mechanically or in ponds.

Scrubber sludge may contain some fly ash depending on the type of coal burned, location of the fly ash collectors, and whether fly ash addition occurs before ponding and

stabilization. The unstable material consists largely of calcium sulfite, unreacted lime, and fly ash components. The calcium sulfite reacts to become the more stable form of calcium sulfate.

Mixing of the fine particles contained in the dried limestone scrubber sludge and fertilization of the soil with nitrogen, phosphorus, and potassium can help support vegetative growth. Fresh unstable sludge may be toxic to plant growth due to the concentration of boron and high pH (basics conditions) resulting from the unreacted lime. Scrubber sludge has some liming value for soils depending on the content of unreacted lime and fly ash. Lime scrubber sludge contains levels of heavy metals requiring a complete chemical analysis including heavy metals, total boron, pH, and liming value from the unreacted calcium carbonate before land application.

5. Fluidized Bed Combustion Waste (FBCW)

Fluidized bed combustion waste (FBCW) occurs as fine coal dust burns in a bed of inert ash and ground limestone. Air injected at controlled rates suspends the bed (fluidized) where the ground limestone reacts with the sulfur dioxide produced during the coal combustion process.

FBCW is a fine granular solid material containing calcium sulfite, unreacted lime, and metal oxides that result in extremely high pH levels. The metal oxides (metals and calcium oxide) convert to hydroxides in the presence of moisture and heat. Further changes occur as hydroxides (calcium oxide) react with carbon dioxide in the atmosphere forming carbonates that stabilize the material. Fresh FBCW has an extremely high pH due to the hydroxides, requiring careful handling and further processing to lower the pH. The calcium oxide requires

stabilization (conversion to calcium carbonate) before land application. Unstabilized FBCW should not be land applied due to the high pH.

Stabilized FBCW provides sulfur and calcium for plant growth and provides a good source of lime for adjusting soil pH depending on the percentage of unreacted lime. As the calcium sulfate and fly ash content increases, the ability to adjust soil pH decreases. The fine calcium carbonate provides an immediate liming value of about 10% with longer-term liming value of about 40%. Transportation costs will limit the use of FBCW as a liming material. Prior to land application, the material will need to have a complete chemical analysis including total boron, alkalinity and liming value.

6. Gas and Oil Drilling Mud

During the drilling of oil and gas wells, special fluids pumped down into the borehole lubricate and cool the drilling bit, float out the loose material, seal porous strata, and prevent the borehole from filling with water. Most drilling fluids (drilling muds) are commonly prepared by mixing different proportions of barite (barium sulfate), bentonite (type of clay), chrome lignosultonate, lignite, and sodium hydroxide. Most drilling muds contain trace elements, petroleum residue, salt-water components, and sources of alkalinity.

Most drilling mud (fluid) undergoes dewatering in catchment basins at the drilling site before handling. The material is handled as a solid (>20% solids), which may be processed onsite or transported to special treatment sites away from the drilling activity. Design and construction of these treatment areas confine the material, and allow inoculation with bacteria that convert the petroleum residues to simple organic compounds. Construction of these "cells" includes an underlying drain field that allows the leaching of soluble components out of

the drilling mud. The insoluble components remain in the "cell" with the drilling mud. Removal of the drilling mud occurs when monitoring indicates that the petroleum residue concentration poses little or no hazard to the environment. The stabilized drilling mud is useful as industrial fill material. Prior to landfarming, drilling mud requires analysis for all required heavy metals plus total arsenic (As), barium (Ba) and mercury (Hg). In addition, analysis should be performed for total polyaromatic hydrocarbons (PAH's), and specialized organics such as alkanes, chlorinated alkanes, and chlorinated aromatics.

7. Oil Production Brines

Oil production brines result from separation of water and oil during the drilling, pumping or extraction of oil from a well. Most of this material returns underground through injection wells following separation in a tank near the producing well. When an injection well is not available for handling the brines, the material falls under the special waste regulations.

Brines are very salty because they are composed largely of sodium-laden waters mixed with the oil underground. Due to the toxic effects that high sodium levels have on plants, there are application rate limitations for landfarming. Before landfarming, analyze this material for sodium, chlorine, alkalinity, and the required heavy metals. Sodium and chlorine content limit the application rates.

Solid Waste

Solid wastes, as defined by Kentucky statutes (KRS 224.01-010(31)(a)) is any discarded material that is not hazardous waste, special waste, coal mining waste or agricultural waste. "Solid waste", as defined, includes liquids and contained gasses. In fact, soil, sand, rock and gravel are solid wastes, and only exempted when they are generated during publicly funded

road construction projects. The so-called "agricultural waste exemption" applies only to manure, crop and crop residue "*when placed on the soil for return to the soil as fertilizers or soil conditioners."* Special wastes are not a subset of solid wastes, a common misperception.

By federal law, an exemption is also provided for solid or dissolved material in domestic or industrial water or wastewater treatment systems while in process, treatment or storage units subject to Kentucky Pollutant Discharge Elimination System (KPDES) permitting requirements. It is important to understand that when such units, including storage or treatment lagoons, are no longer under a KPDES permit or a Kentucky No Discharge Operating Permit (KNDOP), the exemption no longer applies, and those units become subject to waste regulations and permitting requirements. This applies to both special and solid wastes as defined in the Commonwealth.

1. Cement Kiln Dust

Cement kiln dust is a fine granular solid material obtained from the mixing of several waste sources during cement manufacture. Sources include the dust from stack scrubbers, dust collected from grinding rock and shale before heating, and impurities separated out before the raw product passes into the rotary kiln. Contents of the stack scrubber component will depend on the sources of fuel used in the rotary kiln. Some plants may use unconventional fuels (such as wastes) which may result in hazardous components in the stack scrubber material. The cement kiln dust requires analysis for hazardous waste content if the fuel contains any hazardous wastes.

Normally, cement kiln dust is high in calcium oxides, calcium hydroxides, metal oxides and clay. It will contain all of the same metallic elements found in the rock and shale used for

making the product. Because the material contains a large amount of calcium oxides and hydroxides, it will have a very alkaline (high pH) reaction when placed in contact with water.

Cement kiln dust mixed with biosolids is used to reduce pathogens. When mixed with biosolids, the pH of the mixture will increase to 12, significantly reducing pathogen concentrations in the biosolids. In the process of increasing the pH, some nitrogen is lost through ammonia volatilization. After the cement kiln dust biosolids mixture reacts for long periods, the pH falls back to a level suitable for land application. Dewatering of the mixture occurs as the dry cement kiln dust reacts with the water and organic materials in the biosolids. Before Landfarming, this mixture requires analyses for the same parameters as biosolids plus alkalinity.

2. Food Wastes

These wastes are the results of food production and processing, or food supplement processing. These wastes include liquid and solid wastes from various food preparation plants including:

- whey from cheese making and rejected milk from milk processing;
- starch, peels and rejects from potato chips;
- trimmings and rejects of vegetables and fruits from restaurants and grocery stores;
- pomace from fruit processing;
- tomato pulp from catsup;
- hulls and skins from peanut processing;
- dust and hulls from coffee grinding and oil seed extraction; and
- spent media from drug and food supplement manufacturing, to name a few.

As most food wastes are relatively unprocessed, there is a concern for the high biochemical oxygen demand (BOD) levels contained in these wastes. In some cases (whey, potato starch and milk), BOD limits should determine the application rates unless nitrogen or other elements limit land application to lesser rates. On the other hand, some materials (potato peels, cucumber parts, vegetable trimmings, peanut hulls, and oil seed hulls) represent crop residues that are easily land applied. In addition, some of these materials are useful in composting operations because they are relatively easily decomposed.

In addition to the standard waste analysis needed for landfarming, analyze these materials for BOD concentrations and presence of chemicals used in processing. Acceptable landfarming practices of these wastes include frequent application to prevent decomposition resulting storage that leads to odors.

3. Other Solid Wastes

Some solid wastes, such as sawdust, wood chips and leaves, due to their low potential to create nuisance conditions or cause environmental harm, may be land applied under the Permit-by-Rule provisions of Kentucky solid waste regulations. When allowed as a permit-by-rule beneficial reuse, no written application or written authorization is required. In some cases, the person applying the waste, or the waste generator, the land owner or even county officials may require written authorization from the state, in which case an application may be made requesting a Beneficial Use Determination.

All permit-by-rule activities must comply with the Environmental Performance Standards (EPS), which, unless incorporated by disc or plow, would prohibit land application in

a 100-year floodplain. Setbacks from streams or other Waters of the Commonwealth should also be observed, as wash out by rain into the water would be a violation of the EPS.

Wood wastes can benefit soil conditions in the long term, but because they are very high in carbon compared to nitrogen content, with ratios in the range of 200 to as much as 750 to 1 C:N, the immediate impact when applied is to take up available nitrogen from the soil (as bacteria begin to break down the wood fibers) making nitrogen unavailable to plants. Nutrient management should be intensified when wood wastes are applied.

SPECIAL AND SOLID WASTES REVIEW QUESTIONS

Terms of Interest

Aerobic	Heavy Metals
Anaerobic	Lime Scrubber Sludge
Biological Oxygen Demand (BOD)	Oil Production Brines
Cement Kiln Dust	Pathogens
Compost	Primary Sludge
Fluidized Bed Combustion Waste	Secondary Sludge
Fly Ash	Solid Waste
Food Waste	Special Waste
Gas and Oil Drilling	Waste

Study Questions

1. Special wastes are those materials of _____volume and low _____.
2. Sludge is normally applied to the land in the form of a _____ sludge, a _____ solid sludge, and as a solid dry sludge.
3. Wastes classified as special wastes include:
    a) Mining wastes _____.
    b) _____ wastes (fly ash, bottom ash, scrubber sludge, fluidized bed combustion).
    c) _____ and _____ drilling muds
    d) Sludge from _____ and wastewater treatment facilities.
    e) _____ kiln _____.

f) Oil production _____.

4. _____ _____ dust is commonly combined with wastewater sludge to meet pathogen reduction requirements by increasing pH.
5. Some of the microorganisms entering the treatment plant are regarded as _____.
6. A concern of relatively unprocessed food waste is the _____ _____ _____ level of these wastes.

Chapter 2: REGULATIONS

Chapter 2 Objectives

1. Identify and explain the importance of soil, plant and regulatory factors as they relate to site selection.
2. Describe the five (5) regulatory siting requirements.
3. Understand the importance for using a soil survey report and USGS topographical map as it relates to site selection.
4. Comprehend Kentucky regulations as they relate to definition, environmental performance standards, required analysis, permits and the permitting process, operator certification, monitoring and fees. (add operating requirements if we move from Landfarm Management Section)
5. Recognize when Landfarming facilities may be closed.
6. Identify the required components of a closure report when permanently ceasing operation of a special waste Landfarming facility.
7. Understand the post-closure monitoring and maintenance process for Landfarming facilities accepting Type A special wastes.

SITE SELECTION

Any land site on which a suitable vegetative cover or crop can be grown or produced using agricultural practices holds potential for beneficial use of waste materials. Distinguishing more suitable sites from less suitable sites will be the focus of this section. The more suitable sites can accept wastes in nearly any form and with few restrictions on application timing other than those imposed by the growing plants. Less suitable sites may restrict the type or form of waste, the method of application, and the timing of the application. These sites are likely to be more expensive to manage because additional waste processing may be needed, storage may be needed during some periods, or special practices may be needed to alter problems such as steep slopes, karst features (sinkholes), high water tables, and restrictive soil layers.

Site selection involves the recognition of both soil, plant and regulatory factors that will be addressed in this section. Soil factors will be discussed to act as guides in selecting potential sites. Regulatory factors will be listed in order to relay the restrictions imposed during the selection process.

A. Soil Suitability

The ideal soil should be deep, well-drained, and silt loam textured. It should have a black or dark brown colored surface, and reddish-brown or yellowish-brown subsoil. It should not be mottled with gray to a depth of 40 inches. The subsoil should have no restrictive layers within 40 inches. The structure should be stable, and the soils should have a low shrink-swell potential.

The ideal soil should allow water to enter and pass through easily, but not too fast. The infiltration rate should be moderate to rapid, and the permeability should be moderately slow

to moderately rapid throughout. This soil should be nearly level to very gently rolling with slopes between 0 and 3%. The site must not be on an active floodplain.

Very few soils qualify as ideal for waste application. Most depart in at least a small way, for at least one of the critical properties. Those soils that have only a few small departures are still suitable for land application of wastes; their limitation can be overcome easily with a minimum of special management practices. The greater the number of properties that depart from ideal and the greater the degree of departure, the more severely limited the soil. Often soil suitability for land application depends as much on interactions among several soil properties as it does on individual properties. The soil property information is contained in a soil survey report of an area. These reports are published cooperatively by the Natural Resources Conservation Service (formerly the Soil Conservation Service), the University of Kentucky, and the Kentucky Division of Conservation. Soil type at the potential site. By reviewing the soil profile description, each horizon will be described. In order to use Table 1 listed below: (1) find the descriptions of the soil types that are present at the potential landfarming site; (2) by reading the soil type descriptions, find the soil texture of the horizon that has the most clay content; (3) then determine from the description whether any horizons contain gravel; and (4) determine the depth of the soil profile above bedrock. By using this information Table 1 will rate general soil suitability for land application of wastes as excellent, good, fair, or poor. Those soils rated as excellent or good are most suitable for land application. Those rated as fair or poor are generally unsuitable.

Table 1 - Depth/texture rating for land application.

Subsoil Texture	Coarse fragments	Depth to bedrock (in.) >40	20 – 40	<20
Loam	None	E	P	P
	Gravel	G	P	P
Silt loam	None	E	P	P
	Gravel	G	P	P
Clay loam	None	G	P	P
	Gravel	G	P	P
Silty clay loam	None	G	P	P
	Gravel	G	P	P
Silty clay	None	G	P	P
	Gravel	F	P	P

E = excellent; G = good; F = fair; P = poor
Use texture of subsoil horizon that has highest clay content.

A general rating of soil drainage and permeability can be obtained from Table 2. Soil type descriptions will list drainage and permeability categories within the first paragraph. Soil types are divided into two general classes: Those with uniform permeability and those with a restrictive layer (fragipan or claypan) present. Soil types with ratings of E/E, G/E, or G/G are generally suitable for landfarming wastes. Other classifications are generally unsuitable or they will have some problems in adequately handling wastes throughout the year.

Table 2 - Drainage/permeability rating for land application.

	----Drainage class---- WD	MWD	SWPD	PD
Soils with uniform permeability				
Rapid & moderately rapid	G/E	G/E	F/G	F/P
Moderate & Moderately slow	E/E	E/E	G/E	F/G
Slow	G/E	G/E	F/G	F/G
Soils with slowly permeable restrictive layers				
>40 in. depth to layer	E/E	G/E	F/G	F/P

E = excellent; G = good; F = fair; P = poor
WD = well-drained; MWD = mod. well-drained;
SWPD = somewhat poorly drained; PD = poorly drained.

Infiltration ratings for land application are dependent on classification of soil structure terms for the surface horizon found in the soil survey reports into more broad categories. For using Table 3, the following categories are used:

Table term	Soil survey report term(s)
Weak	Weak, moderately weak, very weak
Moderate	Moderate, medium
Strong	Strong, moderately strong, very strong
Massive	Massive, structureless

In the infiltration rating, texture, structure, organic matter, and shrink-swell potential interact to control the rate of water or liquid entry into the soil. Soils rated as E or G/E are generally suitable for landfarming.

Table 3 - Infiltration rating for land application.

(Use only surface horizon data.)

		Loam Silt loam	Clay loam Silty clay loam	Silty clay Clay	
Structure Grade	Organic matter			Shr. – Sw. L-M	H
Weak	0-1%	F/G	F/G	P/F	P
	1-3%	G/E	F/G	P/F	P
	>3%	G/E	G/E	F/G	P
Moderate	0-1%	G/E	G/E	P/F	P
	1-3%	G/E	G/E	F/G	P
	>3%	E	E	F/G	P
Strong	0-1%	G/E	G/E	F/G	P
	1-3%	E	E	F/G	P
	>3%	E	E	G/E	P
Massive	0-1%	P/F	P/F	P/F	P
	1-3%	F/G	P/F	P/F	P
	>3%	F/G	F/G	P/F	P

E = excellent; G = good; F = fair; P = poor
Shr.-Sw. = shrink-swell potential from soil survey report.
(L-M = low to medium; H = high)

Use of sloping sites for land application depends not only on the degree of slope but also on the infiltration rate and the type and density of plant cover. Also, depth to any restrictive layer can limit infiltration into the soil. In Table 4, the infiltration rating from Table 3 is used to determine soil suitability.

Table 4 - Slope effect rating for land application.

(Depth to restrictive layer is greater than 40 inches.)

Infiltration rating (Table 3)

Slope (%)	E	G/E	F/G	P/F	P
0-3	E	G/E	G/E	G	G
3-8	E	G/E	G	F	F
8-15	G	F/G	F	P	P

B. Regulatory site restrictions

There are a few site and soil factors that are specified for evaluating potential land application sites in Kentucky. These specified factors are contained in the Kentucky Administrative Regulations (KAR) dealing with siting requirements for landfarming special waste (401 KAR 45:100 Sec. 5) and solid waste (401 KAR 48:200 Sec. 7). These factors may reduce or limit the land area available at a potential site.

The following are regulatory siting requirements:

a) The site cannot be located within a 100-year flood plain unless the waste is to be injected or if surface applied, incorporation applies regardless of the density of vegetative cover.

b) The site must have soil that is at least 4 ft. deep over such restrictive layers as bedrock, and the seasonal high water table.

c) The soil is not suitable if the permeability rate is less than 0.2 in. per hr. or greater than 6 in. per hr. Suitable soils would include the following permeability classes: moderately slow, moderate, and moderately rapid.

d) The slope can be no greater than 15% for any soil area used for land application.

e) Land area is required to be maintained as a buffer zone between a land feature, object or structure and the land application area. These minimum buffer distances between the land application area and the listed feature are as follows depending on the method of land application.

Buffer zones for special wastes (401 KAR 45:100)

Application Method		
Structure Or Object	Subsurface injection or incorporation	Surface application
Residences & Occupied building	200ft.	300ft.
Water well	200ft.	300ft.
Surface water body	200ft.	300ft.
Karst feature	200ft.	300ft.
Perennial stream	200ft.	300ft.
Intermittent stream	30ft.	50ft.
Ephemeral stream	30ft.	50ft.
Property line	30ft.	50ft.
Public road	30ft.	50ft.

At this time, landfarming solid wastes require slightly different distances for buffer zones as follows:

Buffer zones for solid wastes (401 KAR 48:200)

Structure Or Object	Application Method: Surface Injection	Application Method: All other means of application
Residences & Occupied buildings	250 ft.	500 ft.
Drinking water well	250 ft.	500 ft.
Surface water body	250 ft.	500 ft.
Intermittent stream	250 ft.	500 ft.
Karst feature	250 ft.	500 ft.
Public road	30 ft.	50 ft.
Ephemeral stream	30 ft.	50 ft.
Property line	30 ft.	50 ft.

C. Procedures for site evaluation

When evaluating potential sites and soils at those sites, evaluation should begin by locating the site on a soil survey report and USGS topographic map. This should be followed by making a list of the soil type names located within the potential site and checking distances to features listed in the tables above. The names or symbols should be compared to the description of the soil types in the soil survey reports to determine if the regulatory criteria are met for all soils.

Once regulatory criteria are met, then proceed to establish a rating for each soil type at that site using Tables 1 through 4 listed above. The soil areas rated poor (P) for any grouping should be removed from consideration as suitable as these areas will either be severely limited

in their use for land application or require costly alterations to make them suitable. When most soils are rated as fair (F) in the potential site, then an on site-visit should determine actual properties. Also, when most soils are rated as good (G) or (E) for the soil properties you can proceed to make further assessments of the site. However, an on-site visit should be scheduled before finalizing the soil properties.

This on-site visit may require the help of personnel from the Natural Resources Conservation Service (NRCS) located in your county, or the services of a consultant who may be involved in permit preparation. The published soil survey reports are excellent tools for site evaluation. However, soil survey reports cannot resolve differences that are smaller than four or five acres. This is due to the scale of the soil map, not the general accuracy of the survey report.

During the on-site visit, the soil properties should be determined and recorded on a map of the area. Also, there should be identification of structures, objects and land features that are to be located on the map. Then buffer zones should be measured and adequately marked both on the map and in the field. This can lead to a final measurement and determination of suitable land area for waste application.

A geologic investigation related to groundwater must also be conducted. This step is the basis of developing a groundwater assurance plan that must be submitted in addition to the soils information. This investigation begins with obtaining a geologic map of the area (available from the Kentucky Geological Survey). The proposed site should be located on the map, which will help in identifying any karst features, springs or wells.

SITE SELECTION REVIEW QUESTIONS

Terms of Interest

Site Selection	Kentucky Administrative Regulations
Buffer Zones	Kentucky Statutes
Soil Suitability	Groundwater Assurance Plan
Ideal Soil	Karst Terrain

Study Questions

1. Site selection involves the recognition of:
   a) Soil _____
   b) _____ _____
   c) _____ factors.
2. The recommended procedures for evaluating a potential site:
   a) Locate site on a _____ topographic map
   b) Identify and rate _____ types.
   c) Check distances for _____ zones.
   d) Conduct on-site visit to verify _____ properties.
   e) Identify _____ and _____ that may not be on topo maps.
   f) Conduct _____ investigation relating to groundwater.
3. A slope can be no greater than ____% under Kentucky regulations for any area that is to be used.
4. Soil types are divided into two general classes:

   _____ permeability and _____ layer present.

REGULATIONS

The general principles for regulating land application of wastes involves two factors: (1) provide overall environmental safety in reducing any potential harmful effects from wastes; and (2) maintain a consistent recognition of limits for the land to adequately process wastes. Landfarming is the regulatory term used to define the application of wastes to land for the purpose of beneficial reuse and disposal that does not alter land topography nor disturb the soil below three feet from the surface.

In Kentucky, the legislature enacts legislation, which is codified in the Kentucky Revised Statutes (KRS). These statutes allow regulations to be developed, put in place and enforced. Kentucky Administrative Regulations (KAR) are promulgated by the Cabinet for Natural Resources and Environmental Protection, Department for Environmental Protection, Division of Waste Management at the direction of KRS Chapter 224. These regulations appear under several Chapters of 401 KAR which are included in the Appendix.

In general, the regulations are divided into several specific sections but they will be discussed as definitions, environmental performance standards, required analysis, permits and the permitting process, operator certification, monitoring and fees. Operating requirements will be discussed as part of the section on operation and management.

A. Definitions

At the beginning of each chapter or the first section of any regulations there may be a section defining terms needed for that particular chapter or section. Most of the definitions needed for landfarming are listed in 401 KAR 30:010.

Landfarming applies to a category of special or solid wastes. These are defined in KRS 224.50-760 and KRS 224.01-010, respectively. Special wastes are those wastes of high volume and low hazard which include mining wastes, utility wastes (fly ash, bottom ash, scrubber sludge), sludge from water treatment facilities and waste water treatment facilities, cement kiln dust, gas and oil drilling muds, and oil production brines; or other wastes as designated by the cabinet. Generators of special wastes shall register with the Cabinet and are subject to provisions of KRS 224.46-510, except generators of coal mining wastes, which are regulated under KRS 350.

Solid waste includes any type of garbage, refuse, sludge, and other discarded material, including the solid, semi-solid, liquid, or contained gaseous material resulting from industrial, commercial, agricultural, and mining operations (excluding coal mining wastes, coal mining by-products, refuse and overburden). This waste does not include sand, rock, gravel, or bridge debris extracted as part of a public road construction project, recovered material, special wastes (KRS 224.50-760), solid or dissolved material in domestic sewage, manure, crops, crop residue, or a combination of wastes which are returned to the soil as fertilizer or soil conditioners. Further, solid waste does not include solid or dissolved material in irrigation return waters, industrial discharges (point sources), or nuclear wastes classified as nuclear source, by-product or special nuclear.

For other wastes not specifically designated as special wastes by law there are criteria and procedures (401 KAR 45:210) followed by the Cabinet in making this designation. The criteria seek to more clearly define both volume and hazard of the waste. Any waste generated at greater than 1,000,000 metric tons at a Kentucky facility during the year shall be classified as a

special waste. The waste must also be of low hazard meaning (1) there is a low probability that disposal or landfarming the waste would violate provisions of the environment performance standards (EPS) (401 KAR 30:031); (2) the waste is not classified as hazardous (401 KAR Chapter 31); (3) the primary waste is not mixed or co-disposed with another solid waste or hazardous waste; (4) the waste has a pH between 4.5 and 10; and (5) the level of waste constituents does not exceed the maximum levels of arsenic, barium, cadmium, chromium, lead, mercury, nitrate, selenium and silver specified in 401 KAR 30:031 (5). When wastes are designated as special wastes then all regulations applying to special wastes must be followed.

B. Environmental Performance Standards (EPS)

The environmental performance standards (special waste, 401 KAR 30:031 and solid waste, 401 KAR 47:030) are standards imposed by regulation to determine whether the waste or landfarming site has any potential adverse effects on human health or the environment. These standards provide minimums for (1) floodplain location; (2) effects on endangered species; (3) surface water pollution; (4) groundwater contamination; (5) food chain crop culture; (6) disease vectors; (7) polychlorinated biphenyls (PCB's) in waste; (8) air emissions; (9) safety; (10) public nuisance; (11) wetland designation; and (12) karst terrain. For some factors (surface water, groundwater, food chain crops, and PCBs), they list specific chemical values that cannot be exceeded during operation of a landfarming facility or as a result of regular monitoring.

C. Required Analysis

Any waste material that is to be landfarmed should be analyzed for several chemical and physical parameters to determine its suitability for land application. This information will also allow calculation of application rates for landfarming. As discussed previously, soils at the site

should be analyzed before land application begins to determine the levels of available nutrients that affect the recommended amounts of nutrients that are needed for crops, and to determine if the soil pH should be modified with lime applications before landfarming begins.

1. Waste analysis

The following chemical analyses are to be conducted on a representative sample of the waste:

% Total solids	% Volatile solids
% Total phosphorus (P)	% Total potassium (K)
% Total (Kjeldahl) nitrogen (N)	% Ammonium nitrogen
% Nitrate nitrogen	pH
Total cadmium (Cd)	Total chromium (Cr)
Total copper (Cu)	Total nickel (Ni)
Total lead (Pb)	Total zinc (Zn)
Total polychlorinated biphenyls (PCB's)	

In some cases the waste will need additional analysis based on materials contributing to the waste in order to avoid potential toxic effects on several crops. These include boron (B), molybdenum (Mo), selenium (Se), and total alkalinity to mention a few. When considering the application of utility wastes, some of which may have value as a liming agent, the calcium carbonate equivalent should be determined. Oil drilling wastes and oil brines may need an analysis for polyaromatic hydrocarbons (PAH's). ***If the waste is domestic sewage sludge, waste***

analysis must also include total arsenic (As), total mercury (Hg), total molybdenum (Mo), and total selenium (Se), to meet federal requirements.

Metal concentration values shall be determined and reported on a dry weight basis (401 KAR 45:100 Section 2(7)). Metal analysis of wastes shall be determined in the undried (or as-received basis) sample and converted to dry weight basis using percentage solids according to the following formula: milligrams/liter (mg/L) or milligrams/kilogram (mg/kg) wet weight divided by (% solids/100) = mg/kg dry weight.

2. Soil analysis

During the site evaluation, soil samples should be taken according to a plan approved by the Cabinet or as outlined in AGR-16. The sample should be split into two subsamples after mixing. One subsample should be submitted to a laboratory for analysis of cadmium, chromium, copper, nickel, lead, zinc and PCB's, and the other subsamples should be submitted tot he local county Extension agent for agriculture to determine the following analysis, and to receive nutrient recommendations for crops and any lime recommendations.

Soil pH Buffer pH

Extractable phosphorus Extractable potassium

Total cation exchange capacity (CEC)

Extractable nutrients will be reported as pounds per acre and CEC will be reported as milliequivalents per 100 grams (me/100g) of soil. The recommendations for nitrogen, phosphate and potash will be recommended as lbs/acre of N, P_2O_5, and K_2O per acre, respectively.

D. Permits and Permitting Process

All facilities or sites involved in landfarming special or solid wastes must have a permit. The permit must be approved before any construction or operation can begin at the site. This section will discuss the types of permits and the process involved in obtaining a permit from the Cabinet to construct and operate a landfarming facility. The Cabinet issues two general types of permits for landfarming depending on the type, the chemical analysis, and the volume of waste. The permitting procedures and standards for special wastes are established in 401 KAR 45:030, 45:050, 45:060, 45:070, and 45:100, which appear in the Appendix. For land application of domestic sewage sludge, a federal permit may also be required. The Division of Waste Management can assist you in determining if your facility must also obtain a permit from the U.S. Environmental Protection Agency.

Special Waste

1. Types of permits

There are five types of permits (401 KAR 45:020 and 401 KAR 47:080) that may be issued by the Cabinet depending on the particular waste, intention and nature of the landfarming facility.

a) Permit-by-rule

Facilities or sites are granted this type of permit through specific wording in the regulations. Facilities declared to have this type of permit do not have to make application or register with the Cabinet. Examples as stated in the specific regulations (401 KAR 45:060) may include the following facilities related to landfarming special wastes:

1) Oil production brine pits, and gas and oil drilling mud pits during the active life of the pit.

2) Surface impoundments that are part of a domestic sewage treatment process and that do not contain industrial wastewater.
3) An active site for coal mining also used to dispose of fly ash, bottom ash, and scrubber sludge (combustion wastes).
4) Surface mining or other special waste impoundments having a KPDES permit.
5) Temporary storage of special waste piles.
6) Facilities reusing combustion wastes as an ingredient for manufacturing other products (Examples: concrete, cement, paint, plastics, roofing granules, blasting grit, mine stabilization, etc.).

b) Registered permit-by-rule

This permit category is a registration process used by the Cabinet for certain special waste facilities. They will have a permit following a complete registration by the owner or operator that involved required form submission, review, and acknowledgment. The complete process involves specifying the special waste, sources, amount to be handled, storage, and methods of treatment, mixing and disposal. Some facilities that may require a registered permit-by-rule related to landfarming include (401 KAR 45:070):

1) Facilities engaged in sludge giveaway.
2) Facilities storing and treating special waste not specified in the section on permit-by-rule.
3) Facilities that store or landfarm compost.

When the registered permit-by-rule has been acknowledged by the Cabinet it is expected that the facility will comply with the environmental performance standards (401 KAR 30:031).

Anytime the permit holder wishes to include a new waste, change capacity or change the processes for storage, treatment, reuse, or final disposal of the special wastes at the facility, they must submit a revised registration form to the Cabinet.

c) Emergency permit

The Cabinet may issue an emergency permit that allows for the temporary storage or disposal of a special waste that poses an imminent threat to human health or the environment (401 KAR 45:135). This type of permit may only be issued when the immediate need to store, process or dispose of the special waste greatly outweighs the time required to process a required permit more directly related to the classification of the waste.

Certain conditions affect the issuance, duration and operation for an emergency permit. An emergency permit:

1) Shall be given orally or in writing but if given orally, a written request must be forwarded to the Cabinet within five days.
2) The duration shall not exceed 90 days.
3) The request shall clearly specify the special wastes, the site location, method of treatment, storage, and disposal.
4) The Cabinet may terminate when there is a potential threat to human health and the environment.
5) All operation conducted for the duration of the permit shall be conducted within the limits of the environmental performance standards (401 KAR 30:031).
6) Any wastes remaining at the site after 90 days are to be moved to a properly permitted site.

d) Research, development and demonstration permit

This category of permit may be issued by the Cabinet for a special waste or facility that seeks to demonstrate unproven technology related to either the waste or to handling, treatment or disposal. Requests for this type of permit are handled on a case-by-case basis which may take additional time and require that the request be accompanied by large amounts of additional information for the Cabinet to review before issuance. The request is made on form DEP 7094B entitled "Application For A Research and Demonstration Permit" and must demonstrate one of the following (401 KAR 45:135):

1) That the process for storage, treatment, handling, or disposal is unique, innovative and experimental.
2) That insufficient information exists on the characteristics of a special waste for the Cabinet to make a classification.
3) That permit standards have not been established by the Cabinet for the waste, the process or disposal.

Research, development and demonstration permits may be issued for a period of up to 2 years and may be renewed one time for another 2 year period. All environmental performance standards (401 KAR 45:030) must be followed. Financial assurance requirements as specified in 401 KAR 45:080 must be met. The Cabinet may impose restrictions on wastes, processes or disposal, and provide standards for construction and monitoring.

e) Formal permit

1. Notice of Intent to Apply

To begin the formal permitting process, the Notice of Intent is submitted to the Cabinet. This Notice of Intent is submitted by those persons, businesses or municipalities to indicate their intent to apply for a required permit. The Cabinet should be contacted at the following address or by telephone to obtain the necessary form:

Division of Waste Management

200 Fair Oaks Lane

Frankfort, KY 40601

Telephone: (502) 564-6716

Upon review of the Notice of Intent, the applicant will be notified as to what type of permit application will be required.

The interested parties should request and must submit form DEP 7021 A entitled "Notice of Intent to Apply for a Special Waste Landfarming or Composting Permit" (May 1992). The Cabinet classifies a waste landfarming facility as either a Type A or Type B depending on the following criteria of volume and chemical analysis of the special waste:

Type A

Greater than 250,000 gallons of liquid waste or 250 tons of dewatered waste per calendar year regardless of chemical analysis of waste.

Type B

Less than 250,000 gallons of liquid waste or 250 tons of dewatered waste per calendar year.

Waste Classification based on Analysis

	Concentration (ppm or mg/kg)	
Chemical Element	Type A	Type B
Cadmium	>10	≤ 10
Copper	>450	≤ 450
Lead	>250	≤ 250
Nickel	>50	≤ 50
Zinc	>900	≤ 900

If any one element of the Type B category exceeds the listed values for 2 consecutive samples taken one month apart, then the waste will be classified as Type A.

A waste landfarming facility shall be re-evaluated each year based upon the annual analysis section of the annual review forms and records submitted to the Cabinet. This re-evaluation will be based on the volume and chemical analysis listed above.

The formal permitting process (401 KAR 45:030) will involve discussion of a complete application, public information procedures (401 KAR 45:050), application review, financial assurance requirements (401 KAR 45:080), surface and groundwater monitoring plan (401 KAR 45:160) and permit issuance or denial. The entire process will be required for all facilities classified as needing a Type A landfarming permit.

The permitting process for Type B facility permits may be exempt from publishing a public notice, posting a financial assurance, and monitoring of groundwater. However, the Cabinet may require groundwater monitoring after a review of geological or related factors submitted with the application.

The request for a landfarming permit involves the submission of form DEP 7021 B entitled “Application for a Special Waste Landfarming Facility Permit” which occurs at the direction of the Cabinet and after filing the “Notice of Intent to Apply for a Special Waste Landfarming or Composting Permit”. Since the application is very extensive, some assistance may be necessary in providing technical data for the application. The application should forward to the Division of Waste Management, 200 Fair Oaks Lane, Frankfort, KY 40601.

The Cabinet will determine if the application is complete, and the applicant will be notified that the application is complete. If incomplete, the Cabinet will outline the deficiencies and the applicant will be given time to add the requested materials or information.

The permit application must include form DEP 7094J "Past Performance Information" March 1992) which can be obtained from the Cabinet.

When the Cabinet determines the application to be complete, the applicant shall publish a public notice (Type A permits) supplied by the Cabinet in the newspaper with local coverage of the proposed site. The general public will be given 30 days from the data of publication to submit comments and/or request a public meeting based on interest and the need for information on the proposed landfarming site.

After the public meeting, the Cabinet will proceed to review the application. The personnel in the Cabinet may use other published information that is readily available to assist in making a decision on the application.

Following a review of the application, supporting materials, and any other available materials, the Cabinet will make a preliminary determination to issue, modify or deny the permit. If the Cabinet makes a preliminary determination to issue the permit, a draft construction permit shall be prepared containing the proposed design and operational specifications. If the Cabinet makes a preliminary determination to deny the permit application, it shall issue a notice of intent to deny. If the Cabinet makes a preliminary determination to modify a permit, a modified draft construction permit shall be prepared containing the proposed changes in design and operational specifications.

When the applicant is notified that either a draft permit or a modified draft permit has been issued, the permit applicant shall publish a public notice, supplied by the Cabinet, in the local newspaper. The general public will be given 30 days following the publication date for a

public comment period and to request a formal public hearing before an appointed hearing officer.

After the close of the public comment period and completion of the hearing process, the Cabinet shall issue a decision to either issue or deny the construction permit. This construction permit will be in effect until a Cabinet representative has inspected the site and verified, within 30 days, that the applicant has developed the site according to plans approved for the construction permit.

Before a formal construction/operation permit can be issued, the applicant is required to post financial assurance on form DEP 7094E entitled "Performance Bond" (March 1992). This requires a worst case dollar estimate of the cost of closing the site or facility by a third party if that should become necessary, and the guarantee that money will be available for such closure.

With the satisfactory completion of all factors under the construction permit, the Cabinet may issue a formal permit for operation of the landfarming site for a term not to exceed ten (10) years. The Cabinet will review the conditions of the permit after five years and modify the permit if necessary.

2. Solid Waste

Permitting procedures and types of permits for landfarming solid wastes are similar to special wastes. These procedures are specifically covered in the following regulation: 401 KAR 47:100, 401 KAR 47:110, 401 KAR 47:120, 401 KAR 47:130, 401 KAR 47:140, 401 KAR 47:150, 401 KAR 47:160, 401 KAR 47:170, and 401 KAR 48:200. These procedures are outlined as a

matter of information. Details are listed in the Special Waste discussion above, and the regulations to confirm any specific criteria are cited above.

I. Formal permit process

a) Notice of Intent to Apply (Form DEP 7065)

b) Application for a Landfarming Facility Permit (Form DEP 7064) and Applicant Disclosure Statement (Form DEP 7087) are submitted to the Cabinet following determination of classification.

c) Cabinet determines application completeness

d) Cabinet makes determination to issue or deny permit.

e) If recommendation is to issue, applicant publishes public notice in local paper.

f) Waiting period for hearing request – 30 days.

g) Administrative hearing held if requested.

h) Cabinet issues or denies permit.

II. Other permits (401 KAR 47:080)

a) Permit-by-rule

b) Registered permit-by-rule

c) Emergency permit

d) Research, development and demonstration permit

E. Landfarming Operator Certification

This requirement is put into place to assure both the public and the regulatory agency that adequately trained personnel are on site to assure correct and safe operation of the facility.

Each landfarming facility shall have a certified landfarming operator, and the facility shall not be operated in the absence of a certified operator.

People who desire to be certified as landfarming operators shall submit an application to the Division of Waste Management (Cabinet) at least 30 days prior to scheduled training on form DEP 6031 entitled "Application for Certification" (March 1992). The Cabinet will review the application and any supporting documents to determine eligibility for examination. Examination must be preceded by training determined and scheduled by the Cabinet.

The Cabinet determines eligibility for examination based on education and experience. The applicant should have either received a high school diploma or obtained an equivalency certificate. However, the Cabinet may consider the number of years of experience in a related field, such as water treatment or wastewater treatment, in determining eligibility for examination. The applicant must have at least 1 year experience at a landfarming facility.

The successful applicant will be asked to attend and complete a scheduled training session that will include the following landfarming topics (401 KAR 45:090 Section 6 and 401 KAR 47:070 Section 7):

a) Operation and management of a landfarming facility

b) Wastewater treatment processes

c) Waste characterization

d) Chemical and biological reactions of waste

e) Landfarming design and management

f) Permit application requirements

g) Preventing regulatory violations

h) Complying with environmental performance standards

i) Evaluating site suitability

j) Maintaining landfarming equipment

k) Site and facility safety

l) Duties and responsibilities associated with landfarming operation

Following completion of the training (or acceptance of alternate training), the applicant must successfully complete an examination that is given by the Cabinet. Upon meeting all of the above requirements, the Cabinet may issue a certificate to the landfarming operator for a period not to exceed five (5) years. Certificates must be carried on the person, or prominently displayed at the landfarming facility office. If the certified landfarming operator is scheduled to be away from the facility for more than 14 days during operation, the certified operator must notify the Cabinet of his/her absence at least 10 days ahead of the absence. This notice will specify the person to be an interim operator. The Cabinet will evaluate the proposed interim operator's qualifications and declare that the full-time certified landfarming operator at a facility will be responsible for actions of the approved interim operator.

F. Monitoring

This section of the regulations (401 KAR 45:160 and 401 KAR 48:200 (6)) sets the requirements and criteria for surface and groundwater monitoring of landfarming sites and facilities. These regulations apply to all Type A special waste landfarming facilities, class II and III solid waste landfarming, and any other class of special waste application to land where the Cabinet determines that such monitoring is needed due to any special location or geologic features.

1. Type A Facilities

Any facility landfarming Type A sludge shall sample surface water quarterly at designated sites as approved in the application and permit. These shall include a minimum of 1 upgradient and 1 downgradient sampling point from the facility. Parameters to be analyzed shall include:

Water pH	Ammonium nitrogen
Fecal coliform	Biological oxygen demand
Total organic carbon	Total dissolved solids
Total chromium	

All facilities classified as Type A (special waste) or Class III (solid waste) shall propose a groundwater monitoring plan and receive approval of the plan. The groundwater monitoring system shall reflect the regional and local groundwater flows at the facility. At least 1 monitoring well shall be sampled that reflects water located hydraulically upgradient from the landfarming site. This well should be representative of groundwater not affected by the landfarming site. In addition, at least 2 monitoring wells shall be sampled that reflect water located hydraulically downgradient from the landfarming facility. The following parameters shall be analyzed from water samples taken on a semi-annual basis (401 KAR 45:160 Section 8) and (401 KAR 48:300):

Chemical oxygen demand	Total organic carbon
Total nitrogen	Nitrate nitrogen
Total lead	Total chromium
Total cadmium	Total coliform bacteria

In addition, groundwater elevations in the monitoring well must be recorded.

2. Other Facilities

Surface and groundwater monitoring may be required by the Cabinet for other wastes or other classes of facilities according to conditions and parameters listed above for the Type A facilities. Most of these determinations by the Cabinet will be handled case-by-case based on location of the facility in respect to surface water withdrawals for potable water, and on unique geological features that may allow access to groundwater as determined by reviewing USGS maps during the permit review process.

Due to the nature of the experimental processes, treatments or landfarming methods, there is high probability that the Research, Development and Demonstration permits will require plans for monitoring both surface and groundwaters using the conditions and parameters listed for Type A facilities.

G. Fees

Fees for landfarming special waste are specifically listed in 401 KAR 45:250 of the current regulations. The fee schedule application to landfarming is as follows:

Notice of Intent	$500
Formal Application	$5,000
Request for Variance from Regulations	$500
Construction/Operation Permit	$500
Renewal	$500
Emergency Permit	$500
Research, Development & Demonstration	$2,500
Change of Ownership	$500
Transfer to Existing Permit	$500

Fees for landfarming solid wastes are specifically listed in 401 KAR 47:090 of the current regulations. A copy can be located by visiting the Legislative Research Commission's website at www.lrc.ky.gov.

Political subdivisions in the Commonwealth of Kentucky are exempt from these permit fees. Each application to the Cabinet, other than from political subdivisions, must be accompanied by the appropriate fee.

REGULATIONS REVIEW QUESTIONS

Terms of Interest

PCB	Research Development & Demonstration
Permit	Cation Exchange Capacity
Permit By Rule	Formal Permit
Registered Permit By Rule	Type A and B Landfarm Facility
Emergency Permit	Operator Certification

Study Questions

1. The _____ _____ _____ allow regulations to be developed, put into place and enforced.
2. The _____ _____ _____ are imposed by regulations to determine whether the waste or landfarming site has any potential adverse effects on human health or the environment.
3. Special waste permits are categorized as:
   a) _____ ___ - greater than 250,000 gallons of liquid waste or 250 dewatered.
   b) _____ ___ - less than 250,000 gallons of liquid waste or 250 dewatered tons per calendar year, low concentration of metals.
4. Type B facilities shall be exempt from:
   a) Publishing a _____ _____.
   b) Posting of _____ _____.
   c) Monitoring of _____.

d) Post-closure care.

5. A landfarm operator certification is valid for ____ years.
6. A _____ _____ may be issued for the disposal or temporary storage of waste in response to a situation that poses an imminent and substantial threat to human health or to the environment.

CLOSURE

Landfarming facilities may be closed when waste is no longer available, upon expiration of the permit, or when violations of either environmental performance standards or other applicable regulations have occurred. The Cabinet has procedures that must be followed in beginning the closure process, some of which require action before an order is received from the Cabinet.

As part of the special waste permitting process, an applicant shall have a detailed, current cost estimate of the cost of hiring a third party to close the landfarming facility. This cost estimate serves as the basic value for determining the bonding and financial responsibility requirements for a permit to landfarm Type A wastes. The Cabinet requires that the applicant post financial assurance on form DEP 7094 entitled "Performance Bond" (March 1992) for permits of Type A special wastes. Solid waste Class II and Class III Landfarming facilities are required to post a performance bond.

A. Ceasing Operations

When permanently ceasing operation of a special waste landfarming facility, the permit holder shall submit to the Cabinet a closure report that includes the following:

a) Results of final soil samples taken according to the original permit conditions. These samples are to be taken within 18 months following the last application of wastes.

b) A historical record summarizing all landfarming activities including wastes applied, rates applied to each subplot, total regulated metal (Cd, Cu, Ni, Pb, and Zn) applied (lbs/acre) to each subplot, total nitrogen applied (lbs/acre) to each subplot, and a summary of the annual landfarming reviews.

c) A certification that the landfarming facility is closed and complies with all environmental performance standards (401 KAR 30:031).

d) Any additional information required by the Cabinet related to the permit conditions, which could include groundwater and surface water monitoring.

The Cabinet will review the submitted information and determine if additional monitoring of the site is needed for some extended period.

For landfarming facilities accepting Type A special wastes, there is a post-closure monitoring and maintenance period of 2 years required for fully complying with the closure provisions. This 2-year period begins the day after certification that the facility is officially closed. After completion of the 2-year post-closure monitoring and maintenance, the permit holder shall submit a certification that this period is complete. The Cabinet will review this post-closure certificate and either accept it or require further time for post-closure. When the post-closure certificate is accepted, the financial assurance bond will be released. All costs of post-closure monitoring and maintenance, or additional corrective action will be borne by the permit holder.

CLOSURE REVIEW QUESTIONS

Terms of Interest

Closure

Post-closure

Cost Estimate

Financial Responsibility

Performance Bond

Study Questions

1. A landfarming facility may be closed when:
   a) Waste is no longer being applied.
   b) _____ of the permit has occurred.
   c) _____ of the Environmental Performance Standards have occurred.
   d) Violations of applicable _____ _____ have occurred.
2. Type A facilities are required to :
   a) Post financial assurance.
   b) Perform groundwater monitoring.
   c) Enter into a ___ year post-closure period on the first day after the facility permanently ceased to accept waste.
3. When a facility permanently ceases to accept waste, the owner or operator shall submit a _____ that post closure is compete.

4. At conclusion of the two-year post-closure monitoring and maintenance period, the owner or operator shall submit a _____ that post-closure is complete.

5. The closure report shall include:

   a) The final ____ samples taken within 18 months following the last application of waste.

   b) _____ summary of all landfarming, by subplot, showing the allowable and _____ rates of special waste application, heavy metals and nitrogen, incorporating the annual reviews.

   c) A _____ from the owner or operator that the site is closed an in compliance with the Environmental Performance Standards.

   d) Any _____ _____ required by the Cabinet.

Chapter 3: LANDFARM MANAGEMENT

Chapter 3 Objectives

1. Describe soil properties that influence beneficial use of wastes.
2. Identify the four (4) roles of soil.
3. Identify and explain the collective features of soil.
4. Explain the important soil behavioral properties important for land application wastes.
5. Explain why crop management is important.
6. Describe the importance of soil testing.
7. Identify the effects nutrients have on crops.
8. Understand why conservation practices are necessary.
9. Understand crop and soil management guidelines.
10. Comprehend Kentucky regulations as they relate to operating requirements for Landfarming management. (remove from this section if we move it under the Regulations section)

SOIL PROPERTIES

Site evaluation, selection and management all begin with an assessment of soil properties. These properties determine the physical, chemical and biological processes in soils that affect plant nutrient availability, heavy metal immobilization, waste utilization, and crop management.

A. Soil Properties

This section will be a general discussion of soil properties that influence the beneficial use of wastes. The information on soil properties in this section will help you understand how to evaluate potential landfarming sites and to appreciate the important role soil plays in proper waste management. The four roles of soil in waste treatment are to provide a medium for:

1. Plant root growth;
2. Water and nutrient entry, and movement;
3. Immobilization of metals and other chemicals; and
4. Biological activity to assimilate wastes.

An aerobic environment is necessary for plant growth and for the soil microbes that decompose organic residues and destroy pathogens. Aerobic environments occur when a favorable balance between air-filled pores and water-filled pores exists in the soil system. Soil management for beneficial use of wastes should strive to maintain aerobic conditions in the soil. Ideal soils have about 50% solids and 50% pore space. In Kentucky, one can expect the soil to be comprised of 48% mineral matter and 2% would be organic matter, 25% pore space filled with water and 25% unsaturated pore space.

The soil texture, soil structure, and soil water content affect the aerobic conditions in the soil. Loamy soils, common in most of Kentucky, have good soil structure that provides aerobic conditions. Some Kentucky soils may be more clay and have structure that tends to be less well aerated. Soils saturated with water for long periods tend to be anaerobic and are not favorable for normal decomposition of added wastes. Fragipan soils in some parts of Kentucky have impermeable horizons causing perched water tables that can also reduce the rate of decomposition. These conditions can lead to nutrients being lost into the environment, and rather than being used to grow a crop, they become pollutants.

Soil management for land application must control water movement over and through the soil in order to prevent contamination of surface water or groundwater. The potential for leaching increases as soil permeability and rainfall increase. Soils that are less permeable or have a steeper slope will experience greater surface runoff.

Runoff occurs when the soil cannot absorb the rainfall. Surface runoff increases the potential for contamination of surface water bodies. The runoff potential depends on the soil slope, soil wetness, surface infiltration, and whether the soil is frozen. The amount of vegetative cover, rainfall intensity and use of soil conservation measures also affect the amount of runoff.

Soil can immobilize many metals and other elements or compounds contained in wastes. Soil pH and the cation exchange capacity (CEC) are the primary factors controlling immobilization. The CEC of a soil depends on amount of organic matter and the percentage and type of clay.

B. Collective Features of Soils

The collective features of soil are the result of the natural processes of soil formation and human activity. Such features determine the suitability of soil at a potential landfarming site. These features include texture, structure, color, mottling, horizons, and soil depth.

1) Soil Texture

Soil texture refers to the soil's particle size distribution. Three particle size groups; sand, silt, and clay classify the soil texture. Sand particles feel gritty and are so large that each grain is visible. Silt has a smooth feel like flour or cornstarch. Clay feels sticky when wet and is easily molded. Sand and silt do not contribute much to soil CEC as they have a smaller surface area in a given volume of soil. Clay particles are flat with a large surface area per unit volume, and therefore, make a large contribution to CEC.

Soil texture classifications include the term loam in addition to silt, sand and clay. Loam refers to easily worked, fertile soil, composed of clay, silt, and sand. A clay loam has a clay content of 25-40%, a silt loam has more than 70% silt, and a sand loam has between 50 and 70% sand. Loams heat up rapidly, drain neither too slowly nor too easily, and are well aerated. Kentucky's predominantly silt loam soils are generally well-suited for landfarming.

Clay soils restrict air and water movement, and are difficult to work beyond ideal moisture range. Driving heavy vehicles on clay soils when they are too wet can damage soil structure, reducing the ability of the soil to support a crop, retain nutrients and fix metals within the soil profile. "Heavy", or high clay soils are not allowed to be used for landfarming if permeability is less than 0.2 inches per hour.

Sandy soils drain rapidly, and can be worked over a wide range of soil moisture contents, but don't retain nutrients or metals well. Sandy soils can benefit by the addition of organic matter such as wastewater sludge, but are not allowed to be used for landfarming if permeability exceeds six inches per hour.

In summary, soil texture affects:

1. Porosity,
2. Water movement,
3. Aeration,
4. Water retention,
5. Organic matter,
6. Plant nutrition, and
7. Metal adsorption

2) Soil Structure

Soil structure refers to the aggregation of the individual particles of sand, silt, and clay into larger units called peds. Plant roots, soil organic matter, and clay particles provide the physical and chemical binding for the peds. The shape, size, and grade of peds characterize the soil structure. Granular peds are common in surface soils, which provide balanced air and water relations. Plates occur just below the surface in some soils. Due to their horizontal occurrence, these plates tend to restrict air and water movement. Both blocky and prismatic peds are common in the subsoil, tending to provide large pores between peds (and smaller pores within peds) for more balanced air and water movement.

Soil structure can modify some of the undesirable effects of certain textures (usually higher clay content soils) by creating larger pores between peds that encourage air and water movement. Good structure means good aeration and a favorable balance between air and water containing pores. This balance improves the soil environment for root growth and microbial activity.

Maintaining strong, stable peds is important in any good soil management strategy. Waste can be a valuable soil amendment as it adds organic matter that is vital to the formation and maintenance of good soil structure. In addition, waste application stimulates root growth that tends to bind particles together. Waste application is valuable in providing organic matter to improve soil structure particularly in heavily cropped soils prone to structural deterioration.

Clay tends to form tighter soils due to the chemical attraction. However, moderate amounts of clay tend to shrink and swell in response to wetting and drying, or freezing and thawing thus may help to loosen some soils.

3) Soil Color

Color provides important clues about the nature of the soils in the plant zone. Dark colors (browns) at varying depths below the surface usually mean favorable amounts of organic matter. Usually, the dark colors indicate higher levels of organic matter and a more productive and fertile soil. Since organic matter is a major factor in soil structure development, the darker the soil, the more stable and well-formed the peds.

Yellowish and reddish soil colors indicate a favorable air and water relationship. As plant roots and soil microbes remove oxygen from the soil pores, oxygen from the air above moves in to replace it. The iron oxide coatings on the soil particles cause these colors.

Chemically, these coatings are the same as rust. Iron oxides are stable and, as long as good aeration predominates, these coatings remain and provide the dominant soil color. Well-aerated soils are ideal for plant growth, microbial activity, and provide beneficial conditions for assimilating wastes.

Gray colors at any depth indicate poor aeration due to long periods of wetness or water saturation. When soil pores are full of water, oxygen from the air cannot get into the soils. This creates an environment where the iron oxide coatings begin to change color from reddish or yellowish to gray and become more soluble. These soils tend to be more acidic and less fertile, slowing plant root growth and reducing plant production. Soils that have gray colors near the surface are poorly suited for waste application.

4) Soil Mottles

Some soils have spots, called mottles, of one color in a matrix of a different color, hence the term "mottled" soil. Some mottles appear as splotches of reddish-brown in a gray color. However, it is more common in Kentucky soils to have gray mottles in a reddish or yellowish matrix. Fluctuation of the water table in the soil causes mottling. When water levels are high, the soil pores are saturated and the iron oxide changes to a gray color. As the water table lowers, air reenters the larger pores first, changing the gray color to reddish or yellowish. Soil around the smaller pores remains gray, thus giving the mottled appearance. By understanding these processes, observation of soil colors and particularly soil mottles (if present) can help determine the height and duration of water tables in soils. This information is an indication of internal soil drainage and has a direct application on assessing soil suitability for waste application.

5) Soil Horizons

A soil horizon is a layer of soil parallel to the surface of the earth. The distinct soil-forming properties define each horizon in terms of its texture, structure, color, and parent material. Together, all of the horizons (resembling layers in a layer cake) in a soil constitute a soil "profile." A soil profile description is a complete set of horizon descriptions for all horizons that occur in a soil.

Table 1 lists the master soil horizons. Additional transition horizons indicate zones of gradual change from one master horizon to another.

Table 1 – Master Soil Horizons

O	Litter layer
A	Dark colored surface horizon
E	Strongly leached horizon
B	Distinct subsoil horizon
C	Weathered parent material
R	Bedrock or shale

Some horizons in Kentucky soils are restrictive due to the specific properties of the horizon. Water and air cannot move into and through these restrictive layers as fast as it moves through the soil above these horizons. These layers also prevent normal downward root growth of many common agricultural crops. In most soils, these restrictive horizons create perched water tables during periods of high rainfall as indicated by either zones of all gray color or mottling of gray in a reddish or yellowish color. These include:

- **Claypans** Horizons that have very high clay content, particularly in comparison to those horizons both above and below.
- **Fragipans** Horizons that are very silty and very dense.

The presence of these layers may either severely limit or even disqualify potential sites for waste application due to the occurrence of perched water tables during some seasons of the year. Soil profiles with restrictive layers used for waste application will have increased potential for water run-off due to the restricted downward movement of water. These sites often require conservation practices to manage run-off water.

6) Soil Depth

Soil depth refers to the total depth of the soil horizons above bedrock or shale. In Kentucky, several areas of the state have bedrock or shale close to the surface.

Table 2 - Soil Classification Based on Soil Depth.

Shallow	0 to 20 inches
Moderately deep	20 to 40 inches
Deep	more than 40 inches

These terms do not apply to depth to a restrictive horizon although, from a practical point of view, depth to a restrictive layer more accurately describes the potential rooting zone for most crops and for microbial activity to decompose applied wastes.

C. Soil Behavioral Properties

Several aspects of soil are difficult to measure directly in the field. However, inferences from laboratory measurements or field observations based on soil-forming properties help

classify the soil characteristics. Some of the important soil behavioral properties important for land application of wastes include permeability, infiltration, internal drainage class, available water holding capacity, leaching potential, shrink-swell potential, trafficability, pH, nutrient availability, and heavy metal immobilization.

1) Permeability

Soil permeability is the rate that water moves through the soil. Permeability depends on the amount, size, shape, and arrangement of soil pores, and on the homogeneity of the pore relationships between soil horizons. Water moves through soils in response to both gravity and the attraction between water molecules and soil particle surfaces. Gravity moves water through large pores, while the attractive forces retain water films on surfaces of soil particles.

Since permeability is not directly measurable due to the complex pore structure, it is more convenient to determine hydraulic conductivity. Hydraulic conductivity is a measure of water flowing vertically in the soil. Relating the hydraulic conductivity measurement to soil texture, structure, and horizons provides the soil permeability classification. This classification contained in soil survey reports helps determine site suitability for land application of wastes.

Table 3 - Soil Classification Based on Soil Permeability.

Hydraulic Conductivity (in./hr.)	**Permeability Class**
<0.06	Very slow
0.06 – 0.20	Slow
0.20 – 0.60	Moderately slow
0.60 – 2.0	Moderately

2.0 – 6.0	Moderately rapid
6.0 – 20.0	Rapid
>20.0	Very rapid

2) Infiltration

Infiltration is the rate that water enters the soil through the surface. This depends primarily on the pore number, distribution, texture, and structure. Clearly, coarse-textured soils have much faster infiltration rates than fine-textured soils.

Table 4 - Soil Infiltration Rates Based on Soil Texture

Soil texture	**Infiltration rate (in./hr.)**
Sand	2.0 – 5.0
Loamy sand	1.0 – 1.5
Loam	0.5 – 0.75
Silt loam	0.2 – 0.3
Clay loam	0.15 – 0.3
Silty clay loam	0.1 – 0.2
Clay	0.05 – 0.15

Strong, stable peds at the soil surface create and maintain relatively large pores that encourage infiltration. High organic matter content at the surface helps maintain stable peds. The moisture content and permeability of the soil beneath the surface also affect surface

infiltration. Faster permeability allows soils to dry more quickly beneath the surface and increases infiltration.

Infiltration is important for land application of wastes because of its affect on water quality. Alone rapid infiltration is desirable but if coupled with rapid permeability there is a greater risk of groundwater contamination. This is particularly important when liquid wastes are applied, or when heavy rains follow any waste application. Slow infiltration is a more common problem in Kentucky. Slow infiltration increases surface water run-off and when combined with slope, can increase the potential for surface water contamination.

Following are three important management factors:

- Avoid driving on wet soils to prevent compaction of the soil surface that reduces infiltration and increases run-off.
- Keep organic matter high by adding wastes or other organic residues to the soil.
- Use sod-forming crops in rotation as much as possible**.**

3) Internal Drainage

Internal drainage refers to the ability of free water to move through a soil. Internal drainage is not the same as the permeability of a soil. Internal drainage class determinations occur based on the height that a water table raises in the soil and the length of time that the soil remains saturated.

Drainage affects soil temperature, as wet soils are cold soils. Biological processes that decompose wastes and release nitrogen for plant use do not operate as fast in cold soils. This can often delay the normal release of nitrogen from land-applied wastes, and can increase

denitrification (gaseous loss of nitrogen). Denitrification reduces the efficiency of nitrogen supplied for plant growth.

Internal drainage also indicates the depth of soil available for plant root development and the uptake of soil nutrients. As these processes occur mainly in aerobic conditions, only the soil volume above the water table is available for waste utilization. Climate dictates the amount and frequency of rainfall, hence the frequency of high water tables. Direct observations of water table fluctuations seldom occur. A study of these conditions generally occurs during dry seasons using evidence of color and mottling to determine the height of the water table.

Table 5 lists internal drainage characteristics based on soil depths to which there is no evidence of gray colors or gray mottles.

Table 5 - Internal Drainage Characteristics Based on Depth to Mottles

Internal Drainage	**Depth in Inches**
Excessive & somewhat excessively drained	>40
Well-drained	30 – 40
Moderately well drained	20 – 30
Poorly drained	10 – 20
Very poorly drained	<10

4) Available Water Holding Capacity (AWHC)

Available water holding capacity refers to the amount of water that soils can store for plant use. Soil texture and structure influence AWHC depending on the number and size distribution of soil pores.

Because gravitational water passes through the large pores, draining out as soon as the water table drops, very little remains available for the plants. A soil is at field capacity when gravity has removed the excess water. Plants remove water easily when soils are at field capacity; however, with each increment of water removed it is harder for plants to remove the next increment. When a soil is so dry that plants can remove no more water, the soil is at the wilting point. Water that remains in the soil at the wilting point is unavailable water.

AWHC is expressed as the number of inches of water that can be stored in the top 40-inches (or to the depth of root limiting layer) of the soil profile. Each soil texture class has a characteristic AWHC, expressed as inches of available water per inch of soil depth. Soil Survey Reports for each soil series and soil type mapped within the scope of the report contains information on AWHC. Ideally, soils selected for landfarming should have a high AWHC (>5.2-inches) in the upper 40-inches of soil.

5) Leaching Potential

Leaching refers to the downward movement of materials in solution carried by water passing through the soil. Leaching potential is a composite property based on interpretation of the soil's infiltration, permeability, AWHC, and hydraulic loading. Leaching potential balances all water inputs against all water losses. Inputs include rainfall, irrigation, or liquid from wastes added to the soil. Losses include evaporation from the soil surface, transpiration by plants, and

surface run-off. When inputs exceed losses, water passes through the soil (leaching). Leaching potential is high during periods of high rainfall with low potential evaporation, and low during periods of low rainfall and active plant growth.

6) Trafficability

Trafficability refers to the soil's ability to support the weight of land application or farm equipment with a minimum of compaction or deterioration of soil structure. Trafficability is important because:

1) Compaction and rutting of the soil reduces infiltration and permeability;
2) Loss of traction can delay and increase the cost of waste application; and
3) Crops do not grow as well in compacted and rutted soil, and the potential for surface run-off is greater.

No soil management practice is more important than avoiding traffic when soil is too wet. The resulting compaction can cause significant damage very difficult to correct.

Trafficability depends on soil texture, moisture content, and plant cover, with moisture content being the most important factor. All soils support weight when they are dry and lose stability when they are wet. Silt loam soils, such as in Kentucky, have the lowest stability when wet and are the most susceptible to compaction. Wait until silt loam soils are considerably less than field capacity before driving large equipment over the site.

If you are uncertain about current soil conditions, the county agricultural extension agent can help you determine when soil conditions are favorible. A good working relationship with the county agent can be an important component of a land application program.

7) Shrink – Swell Potential

To a greater or lesser degree, clays tend to expand when wet and shrink when dry. Modest shrink-swell activity is beneficial in forming a well-developed soil, and is important in overcoming some slight compaction problems. Most Soil Survey Reports contain information on the shrink-swell potential of soils mapped within the area. Any soil rated "high" requires careful management for waste utilization. When these soils become dry, they shrink to the point that deep, wide cracks form in the soil. Masses of soil between the cracks have such tiny pores that water penetrates only the large cracks. When these "high" rated soils become wet, the cracks close so tightly that the soil becomes one large mass. These conditions decrease soil AWHC when dry, restrict permeability when wet, and provide a hostile environment for biological activity when either wet or dry. To overcome this limitation, continual addition, and incorporation of matter from wastes into the surface soil is necessary.

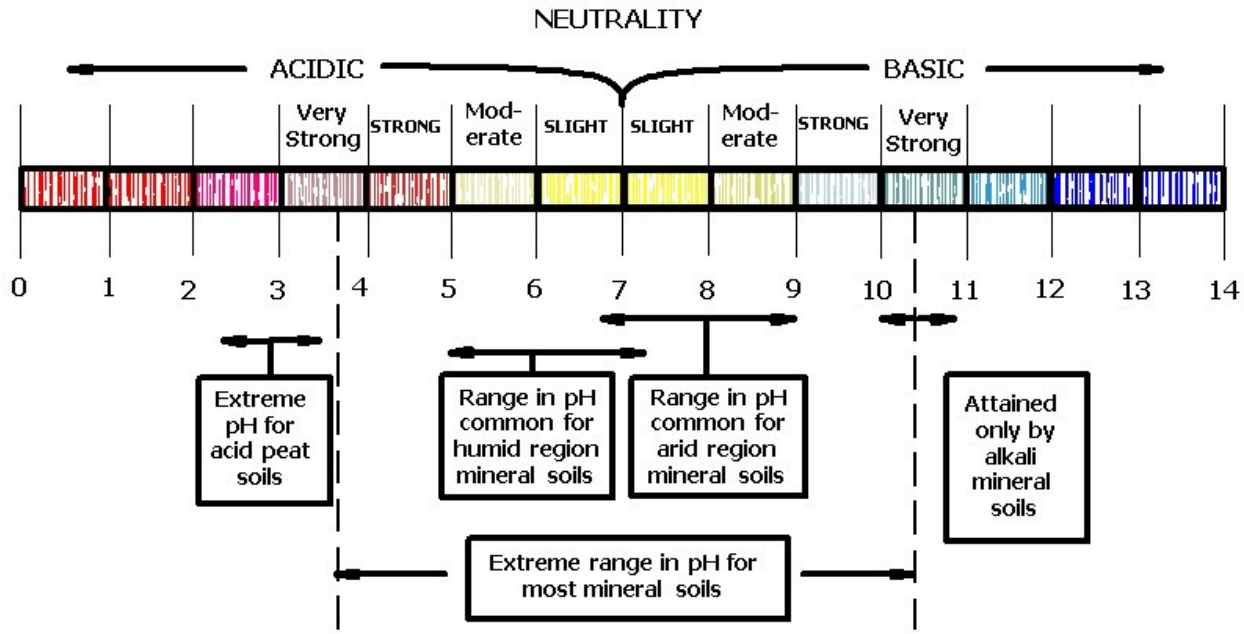
8) Soil pH

Soil pH is a measure of the degree of acid or base conditions of the soil. Technically, pH is a measure of the concentration of hydrogen ions in the soil solution. The pH scale runs from zero (0) to 14, with seven (7) being neutral. A pH lower than seven (7) indicate acidic soils while a pH greater than seven (7) indicate basic or alkaline soils. To measure soil pH accurately, use a pH meter in the laboratory. To measure the general indication of pH in the field, use color indicator papers.

Ultimately, you will need to determine soil pH at the intended site for waste application. First, sample the soil following procedures listed in the Cooperative Extension Service publication AGR-16 (Taking Soil Test Samples). Onsite sampling and laboratory analysis is the

only way to determine this important chemical property. **Figure 1** depicts the various pH levels of soil.

Figure 1: The pH Scale



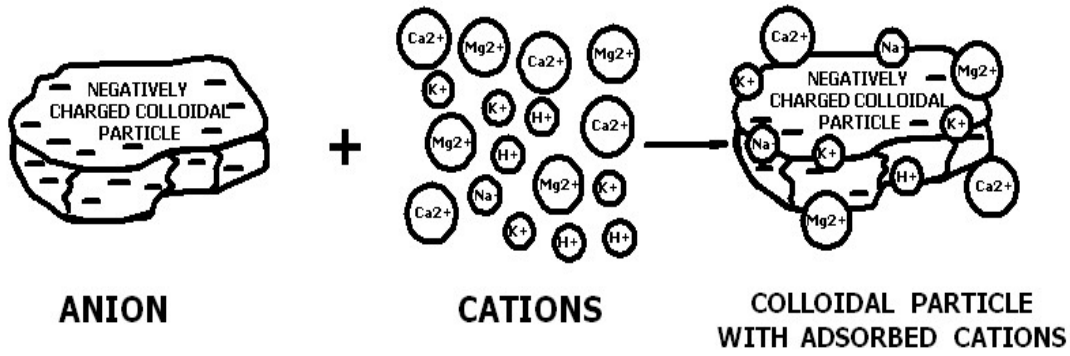
9) Nutrient Availability

The best way to determine availability of soil nutrients to growing crops is to take a soil sample following procedures listed in publication AGR-16 and have the sample analyzed in a laboratory using procedures adapted for Kentucky. Some nutrients such as potassium, calcium, and magnesium carry a positive charge in the soil called cations. Others, such as phosphorus and nitrate, carry a negative charge called anions.

Clay particles and organic matter have a net negative charge in the soil and are therefore able to retain the positively charged ions (cations). The ability of a soil to hold these cations depends on the cation exchange capacity (CEC), which is a measure of the amount of

negative sites available to attract the cations. The unit to describe the CEC value is milliequivalents per 100 grams soil (meq/100g.). CEC is not subject to large changes through the addition of organic matter. However, organic wastes applied to the soil can temporarily provide additional bonding sites for cations.

Figure 5: Soil Cation Exchange



The availability of nutrient anions depends mainly on their solubility in water and the rate of water movement in soil. Anion exchange capacity is not important in the retention of nitrate and phosphorus in the soil. Nitrate management with organic wastes depends on proper management of the organic nitrogen reservoir. The objective is to encourage conversion of organic nitrogen to nitrate nitrogen at times when plants are actively growing and able to utilize the nitrate. Phosphorus in soils either occurs as inorganic compounds or is in the organic form. These inorganic nutrient compounds are most available to plants when the soil pH is in the ideal range of 6 to 7. Organic matter decomposition slowly releases phosphorus into the environment.

10) Metal Immobilization

Metals of concern in land-applied waste include cadmium, chromium, copper, nickel, lead, zinc, molybdenum, boron, selenium, and arsenic. Of these, cadmium, chromium, copper, nickel, lead, and zinc are present as cations in the soil, while molybdenum, boron, selenium, and arsenic are anions. Many of these elements are toxic to plants, animals, and humans if present in large quantities either in the soil or in plant materials when consumed.

The objective is to immobilize these elements during the land application process in order to prevent high levels from becoming available for plant uptake. This is accomplished by:

1) Restricting the annual application rates of some metals
2) Restricting the total application of metals for the life of the site
3) Recognizing the agronomic limits of some other elements that may cause toxicity symptoms in plants and
4) By maintaining soil pH at 6.5 or above

Immobilization of some of the cations occurs through attachment to the cation exchange sites available in the soil. This requires that the CEC be determined for each land application, thus the ability of the soil to immobilize the metal cations. Analysis of the metal anions in each waste will determine the levels that will be land applied, and if there may be conditions for potential plant toxicity.

Soil pH also affects metal availability to plants. With the exception of molybdenum, most metals are more soluble in lower pH soils. To avoid high metal availability to plants, maintain the soil pH at 6.5 or above during and after waste application. pH level of 6.5 and above will promote the formation of insoluble metal compounds that immobilize most metals.

Most soils in Kentucky are normally acidic (lower than 6.5) and require regular sampling to determine soil pH. If pH adjustment is required, apply agricultural grade limestone at rates slightly higher than normally recommended for crop production. Before waste application, apply and incorporate lime to raise pH for maximum metal immobilization. After waste application begins, apply lime to maintain soil pH. In some instances where soils are acidic and incorporation is not possible, surface applied lime will require considerable time to change pH.

SOIL PROPERTIES REVIEW QUESTIONS

Terms of Interest

Soil Properties

Soil Texture

Soil Structure

Mottle

Soil Horizon

Permeability

Infiltration

Leaching Potential

Traffic ability

Shrink Swell Potential

Soil pH

Nutrient Availability

Cation Exchange Capacity

Metal Immobilization

Study Questions

1. Site evaluation, _____ _____, and site management all begin with an assessment of _____ _____.
2. The potential for runoff depends on:
   a) _____
   b) _____ infiltration.
   c) _____ of the soil.
   d) Amount of _____ _____.
3. Soil particles are classified in 3 groups:
   a) _____
   b) _____
   c) _____

4. Mottling is caused by a _____ of _____.

5. Fragipans are soil horizons that are very _____ and very _____.

6. Soil textures affect:

    a) _____

    b) Plant _____

    c) _____ absorption

    d) _____

    e) _____ _____

    f) _____ retention

    g) _____ matter

SOIL AND CROP MANAGEMENT

Designing, implementing and evaluating a plan for land application of wastes requires working within the landowner's or site operator's existing management system and the limitations imposed by regulations affecting the land application process. Waste utilization may have some effect on crops to grow, the crop rotations to use, lime requirements of the area, and conservation practice needs of the area. Crop management will dictate when a field is accessible, the frequency of waste applications, the expected amount of some nutrients that can be applied, and the application methods. Some limitations will be imposed on landowners by the various programs of the ASCS/USDA that may affect timing of seeding, and practices needed to control erosion for some identified soil areas that are part of the Food Security Acts of 1985 and 1990.

Landowners or contractors need to determine whether a farm conservation plan is on file for the proposed landfarming area from the local NRCS office. The Food Security Acts require that all land be assessed for erodibility as defined in this legislation. The landowner may be required to file a farm conservation plan for all cropland. Without this assessment and conservation plan, both the landowner and any person leasing any part of the farm may lose USDA program benefits on all land that they either own or lease. The farm conservation plans must be fully implemented by January 1, 1995.

A. Crop Choice

Pasture and grasses for forage offer the greatest flexibility for land application as access is not as limited by the crop's growth stage. In many cases wastes can be applied when ever

climatic and soil moisture conditions are favorable. The sod created by these crops also promotes infiltration, reduces erosion and enhances site traffic ability.

Some disadvantages that should be considered include: (1) wastes cannot be incorporated without damaging some percentage of the crop; (2) about 50% of the ammonium form of nitrogen is lost following surface application of wastes; (3) some physical benefits of wastes cannot be fully realized with surface applications; (4) subsurface injection of liquid wastes will reduce stand of an established sod; and (5) there is usually a waiting period between the last waste application and either animal grazing or hay harvesting.

Grain crops are well suited for waste application, although frequency may be limited to a single annual application about 1 month prior to planting. With the necessity of reducing tillage for crop production, many land areas will be limited to surface applications of wastes without incorporation. In Kentucky, the fall application of wastes should only be utilized when cover crops or fall seeded small grain crops can be successfully seeded. Rates should be limited to recommended nitrogen based on nitrogen that could move to the groundwater through leaching during the heavy rainfall months of the winter.

There are some restrictions (covered in the Regulations section) under certain conditions on the type of crops that can be grown on waste amended soils. These include direct food chain crops, those directly utilized by humans and those fed to animals, which in turn are consumed by humans. Legumes such as alfalfa, vetch, clovers (red or white flowered), lespedezas, and soybeans all have the ability to fix nitrogen from the air that is needed for plant growth. Therefore, they take up very little soil nitrate arising from decomposition of the waste

materials. Waste applications to legumes will result in excessively available nitrogen that has the potential of being leached to the groundwater.

B. Soil Testing

Soil testing is the basis for planning, designing and evaluating good management of nutrients for crop programs using waste materials as nutrient sources. This practice is essential in evaluating available nutrient supplies in soils at proposed sites and for formulating lime and nutrient recommendations prior to land application. Samples will need to be obtained as part of the site evaluation and planning process after determination of the final available land application areas (subplots). This will serve as the basis for determining nutrient recommendations that affects crop choice and rate of waste application. The continued monitoring of available nutrients will require that samples be taken annually from the land application areas.

Getting a good sample is essential for obtaining reliable soil test information and recommendations. Guidelines for taking and handling soil samples are listed in AGR-16 (Taking Soil Test Samples) published by the Cooperative Extension Service (See Appendix). Each sample should represent an area no larger than a subplot to which wastes will be applied (20 acre maximum).

Soil test levels for phosphorus and potassium are the basis for recommendations for crop needs. The soil pH denotes the current soil pH, and the buffer pH is used to make lime recommendations to achieve the minimum pH (6.5) necessary for waste application. Since nitrogen soil values fluctuate so widely in soils due to environmental and biological conditions, there is no soil test used to predict nitrogen recommendations. Instead the nitrogen

recommendations result from long-term research studies under controlled conditions with the various crops. These studies determine crop yield following rates of nitrogen addition, which is then formulated into recommendations.

C. Nutrients

Most wastes contain all of the nutrients needed for plant growth but the ratio of nutrients in the wastes is not commonly the same ratio as required by plants. Wastes should be viewed as fertilizer products for growing plants just like commercially obtained fertilizer materials. Research has indicated that nutrient availability over time is different for wastes as compared to commercial fertilizers, and not well defined because of the different materials that make up the waste. However, once a waste nutrient becomes available to the plant through the various decomposition processes, it will have the same effect on plant growth as the nutrient would if obtained from a commercial fertilizer source.

The amount of nutrients needed for producing various crops are suggested through nutrient recommendations listed in AGR-1 (Lime and Fertilizer Recommendations) as published by the Cooperative Extension Service (See Appendix). The lime and nutrient recommendations are based on long-term research to correlate soil test data and nutrient application data with crop nutrient needs on crops that are to be grown where wastes are to be land applied. Once nutrient recommendations are obtained, any residual levels from previous nutrient or waste applications must be subtracted to determine the current year's needs. This value will then be used to determine waste application rate based on nutrient availability from the waste.

Currently Kentucky is using nitrogen (or cadmium) as the determining factor for the annual rate of waste application. Some wastes will deliver more phosphorus and potassium to the soil

than is removed by the growing crop. These excesses add to the nutrient pool or levels of available nutrient in the soil. When wastes are continually applied over a long period of time, especially on the surface without incorporation, there is some concern for phosphorus and potassium build up at or near the soil surface. This can become important for the quality of runoff water thus placing more importance on controlling both runoff and erosion from a land application site.

Another factor influencing land application is liming to raise soil pH. Because soil pH affects metal immobilization and has a minimum level (6.5 or higher) that must be maintained at each site, it becomes important in crop and soil management. Farmers usually apply lime only when there is an economic benefit based on the crop and the lime recommendations. With land application of wastes, the need to reach and maintain the minimum regulatory level determines the frequency and the rate of lime application. In most cases, the subplot should receive more lime than is needed for economic crop growth thus the lime rate will be higher than that recommended for normal crop production.

D. Conservation Practices

Runoff, run-on, and erosion control are essential to land application of wastes. Overland flow from the site (runoff) increases the potential for contamination of surface waters. Water flowing to the site (run-on) may increase the runoff and the amount of water that needs to be safely handled at the site. Erosion increases sediment loads to surface waters and may carry waste solids to the surface waters.

Conservation practices are designed to slow down water velocity and increase infiltration. Sod crop plant covers (pasture and hay) are very successful in slowing water runoff and

increasing infiltration. Reduced or no-tillage methods are highly successful in reducing soil erosion and increasing infiltration for grain crops due to the residue cover that remains on the surface throughout the year.

As slope increases, the emphasis on conservation practices increases. More permanent sod crops are particularly valuable for controlling erosion. No-tillage methods are recommended for grain crops. In several cases it may be necessary to adopt practices such as planting row crops on the contour, and growing row crops in strips alternated with strips of sod crops. Some sites may require the construction of diversion terraces to interrupt the down slope water flow to avoid runoff reaching a high velocity. There should be an initial on-site determination of the need for these practices by personnel from the local Natural Resources Conservation Service office. In many cases, these practices may be needed as part of the farm conservation plan that must be in place for maintaining compliance with the Food Security Acts of 1985 and 1990. The farmer or landowner will need to review these needs with the local Agricultural Stabilization and Conservation Service (ASCS) office administering farm programs.

SOIL AND CROP MANAGEMENT REVIEW QUESTIONS

Terms of Interest

Crop Management	Subsurface Injection
Food Security Acts	Infiltration
AGR-16	Traffic ability
Soil Conservation Service	Legumes
USDA	Subplot
Grain Crop	Metal Immobilization

Study Questions

1. Crop management is important because it will dictate:
   a) When a field is _____.
   b) _____ of waste application.
   c) Expected amount of some _____ that can be applied; and
   d) Application _____.
2. _____ and _____, as a crop choice offer the greatest flexibility for land application.
3. Legumes such as alfalfa, vetch, and clovers have the ability to fix _____ from the air that is needed for plant growth.
4. The maximum acreage one composite soil sample can represent as a subplot is _____ acres.
5. Laboratory results must be reported to the division in _____ and _____.

6. The Division's approved method for analysis of soils and sludges is the E.P.A.'s _____ test method.

7. Metal immobilization is affected by soil _____.

LANDFARMING MANAGEMENT

Management of a landfarming facility includes the consideration of regulations, crop growth patterns, weather conditions, and the soils' ability to handle applied waste while promoting plant growth. Systems of landfarming should have some plants grown in which all or part of the plant can be removed from the land area in order to reduce the nutrient load imposed by waste application. This requires attention to good soil and crop management principles that encourage a high level of crop productivity resulting in high nutrient removal from the land area. This section will review crop and soil management guidelines, and regulations that will impose further restrictions.

A. Crop Selection and Management

Grain producing crops are the main crops that can benefit from high nitrogen containing wastes as well as the phosphorus and potassium. Most grain crops (except soybeans) have a high nitrogen requirement which benefit from the nitrogen. These crops have an additional advantage in that heavy metals do not tend to accumulate in grain as much as in the leaves of the plants.

Annual and perennial grasses used for pasture or hay also benefit from high nitrogen containing wastes as well as the other nutrients. Because forages are fed to livestock, there is an additional step of biological processing. Surface contamination of plant material by recently applied wastes may be a special hazard to grazing animals. It is recommended that pastures or hay fields be grazed or cut short just before waste application.

Legumes (alfalfa, vetch, clovers, and soybeans) have the ability to fix nitrogen from the air for their plant needs. Therefore, these crops do not receive additional benefits from nitrogen

contained in the waste. In fact, applications of additional nitrogen will result in total nitrogen supplies for the legumes that may lead to leaching or other losses, will likely reduce the legume percentage in the hay or pasture field, and will certainly decrease the nitrogen utilization from the waste.

Plants and crops vary in their ability to take up and accumulate heavy metals either in the whole plant or in different parts of the plant. Based on current knowledge of crop tolerances of heavy metals, tobacco and vegetables (lettuce, cabbage, beets, kale, mustard, radishes, turnips, tomatoes, etc.) are very sensitive. Corn, soybeans and small grains are moderately tolerant. Most forage grasses (fescue, bluegrass, timothy, orchard grass, ryegrass, etc.) are more tolerant. With any plant, the concentrations of heavy metals in the vegetative tissues (stems and leaves) are much higher than in the fruits and seeds.

Nutrient recommendations based on soil test results should be used for waste application rates. In order to keep some long-term balance of nutrients on the land area, the amount of nutrients (nitrogen, phosphorus, and potassium) removed in the harvestable portion of the crop should be close to the amounts added in the waste. If an excess of addition over removal continues over a long period, there is an increasing potential of some nutrients, particularly nitrogen, either leaching into groundwater or leaving the landfarming site in surface runoff. If the harvestable portion of the crop is not removed, this excess will become important very early in the life of the landfarming systems.

B. Operating Requirements

These requirements for landfarming management are imposed by regulation (401 KAR 45:100, Section 6; 401 KAR 48:200, Section 8). They are designed to assure some consistency from site to site in operating landfarming facilities.

1. All sludges must be processed to significantly reduce pathogens (PSRP) prior to land application.
2. A certified landfarming operator shall be available at the landfarming site during application.
3. Incorporation of wastes must occur within 48 hours if incorporation is included in the management plan. ***(Sewage sludge incorporated as a means of complying with 40 CFR 503.33 vector attraction reduction requirements must be incorporated within 6 hours).***
4. Surface application without incorporation can only be used where either vegetation or crop residue covers at least 75% of the land surface.
5. Hazardous wastes or waste mixtures containing hazardous wastes cannot be landfarmed.
6. Toxic wastes cannot be stored, treated or land-farmed at a landfarming facility.
7. Leafy vegetables or root crops cannot be grown and harvested for human consumption within 12 months of the last waste application.
8. Other crops cannot be grown and harvested for direct human consumption within 2 months of the last waste application. ***(For sewage sludge, the additional food crop restrictions of 40 CFR 503.32 (b)(5) may apply.)***

9. Dairy animal grazing is prohibited within 6 months and other animal grazing is prohibited within 3 months of the last application.
10. The annual application rate of cadmium (Cd) cannot exceed 0.44 pounds per acre.
11. Food chain crops cannot be utilized in the cropping season when annual cadmium (Cd) application exceeds 0.44 pounds per acre.
12. Tobacco cannot be harvested within 5 years of the last waste application if the annual cadmium (Cd) application exceeds 0.44 pounds per acre at any time during the life of the landfarming site.
13. The general public shall be restricted from the waste application area during application and for at least 12 months after the last application unless the waste has undergone a Process to Further Reduce Pathogens (PFRP).
14. Waste shall not be applied when the soil is frozen, snow-covered, ice-covered, water saturated, or during any precipitation event.
15. Waste shall not be applied at rates in excess of those approved in the permit.
16. No raw or unstabilized waste shall be landfarmed.
17. Surface waste applications shall not be greater than one-half (1/2) inch in average thickness.
18. High pressure applications that produce aerosols are prohibited.
19. Subplots are to be staked or clearly marked in the landfarming area.
20. A sign shall be posted at the entrance to the landfarming facility indicating operator name, permit number, contact person, and emergency telephone number.
21. Surface water or liquid waste ponding within the application area shall not occur.

22. Both surface runoff and run-on shall be controlled.
23. Records of all waste application rates and dates, and all laboratory analyses for wastes and monitoring are to be maintained on Cabinet-approved forms during the landfarming operation.
24. Each permit holder shall submit a form entitled "Annual Landfarming Review" (March 1992) to the Cabinet 60 days prior to the anniversary date of the permit.
25. Soil in the application areas shall be sampled and tested annually.
26. Waste shall be analyzed for percent total solids, pH, ammonium nitrogen, nitrate nitrogen, total Kjeldahl nitrogen, total phosphorus, total potassium, total PCB's, total cadmium, total copper, total lead, total nickel and total zinc to be reported as mg/kg wet and dry basis. ***(Include total arsenic, total mercury, total molybdenum, and total selenium if domestic sewage sludge, per 40 CFR 503.13).***

For sludges, the following sampling schedule is to be observed:

Design Capacity (gallons/day)	Samples/Year
<1,000,000	2
1,000,001-10,000,000	4
>10,000,000	12

(Compare to 40 CFR 503.16, Table 1)

27. Soil pH in the sampling depth shall be maintained at 6.5 or greater during any crop production or animal grazing.
28. Wastes containing > 1 mg/kg PCB cannot be landfarmed.
29. The amount of annual nitrogen application cannot exceed the crop utilization amount.

30. The maximum amount of cadmium, copper, lead, nickel, and zinc to be applied for the life of the site is based on the initial cation exchange capacity (CEC) of the soil and cannot exceed the amounts listed below:

	Cation Exchange Capacity (meq/100g)		
Parameter	0-5	5-15	15+
	(Pounds per acre)		
Cadmium	4.46	8.92	17.84
Copper	125	250	500
Lead*	500	1000	2000
Nickel	50	100	200
Zinc	250	500	1000

Maximum lead loading for sewage sludge, by federal rule, is 267 pounds per acre.

The following equation is to be used to calculate the maximum amount of waste (tons/acre) that can be landfarmed for each of the above metals:

Tons/acre = lbs metal allowed per acre/[(dry mg/kg of metal in waste) x (0.002)].

31. If the heavy metal applications exceed the amounts listed in the above table, the owner or operator shall immediately cease application, begin closure and submit a closure report to the Cabinet. This report shall include a copy of a notice that will be placed in the deed advising all future landowners that heavy metal concentrations exceeded those allowed by regulation. ***For domestic sewage sludge, there are additional record keeping and reporting requirements in 40 CFR 503.17 and 503.18.***

LANDFARMING MANAGEMENT REVIEW QUESTIONS

Terms of Interest

Annual Grass

Perennial Grass

Annual Landfarming Review

Parameter

PSRP

Study Questions

1. Prior to land application, all sludges must be _____ to _____ _____ _____.
2. The annual application rate of cadmium (Cd) cannot exceed _____ pounds per acre.
3. Incorporation of wastes must occur within ____ hours after application of wastes.
4. Surface application may be done only when established vegetation or crop residue cover is at least ____% of the land surface.
5. Dairy animals are restricted from grazing for ____ months, all other livestock for ___ months after the last waste application.
6. Special waste shall not occur on land where leafy vegetables or root crops for human consumption will be harvested within ___ months.
7. The general public shall be restricted from the application zone for a period of ___ months after each application.
8. The required posted sign at the entrance of a permitted facility shall contain:

a) Indicate the _____ and type of waste.

b) Type of operation.

c) Name of the _____.

d) _____ number.

e) Contact person.

f) _____ telephone number.

Chapter 4: LANDFARM SAFETY

Chapter 4 Objectives

1. Characterize the three (3) broad categories of hazards.
2. Define the elements of an Employee Right to Know Program.
3. Identify the components of a Material Safety Data Sheet (MSDS).
4. Understand the importance of protection from physical hazards including, proper protective equipment and maintaining equipment in safe working condition.
5. Understand the importance of protection from biological hazards.

SAFETY

Safe operation of landfarm activities is only possible with the complete cooperation of all personnel participating in the operation. This cooperation will only be achieved if there is a mutual trust and respect between members of management and labor. Concern for the welfare of all employees must be evident to maintain a safe workplace. A safe workplace does not mean a workplace free of all risks. It does mean a workplace where every attempt is made, by all involved, to recognize and minimize hazards and to train each employee in the proper procedures to manage those hazards.

Landfarm operations will involve certain risks because of the potential for encounters with: heavy equipment used in processing and application, transportation hazards during collection, foreign materials contained in raw materials, vectors, pathogens, noise, dust, fire, etc. Landfarm activities will involve risk, but those risks do not need to be unreasonable. Fairness to workers require that a thorough understanding of the risks and hazards present be conveyed to them; and, that workers receive training to deal with potential hazards.

The economic impacts of unsafe operations cannot be ignored. The direct cost of treatment for injuries or disabilities, employee death, equipment and facility damage, increased insurance cost, as well as the damage to worker morale and productivity will negatively impact the success of the operation. The effects of accidents and unprotected exposure to occupational hazards can and will overwhelm operational budgets.

In addition to fairness and economic concerns, safety on the worksite is mandated by U.S. Occupational Safety and Health Administration regulations. The regulations contained in 29 CFR Part 1910 have been adopted by the Kentucky Occupational Safety and Health Standards

Board as 803 KAR 2:300 through 2:320. OSHA regulations require employers to make employees aware of hazards they face in the workplace. Additionally, they must be trained to respond to those hazards in a safe manner. While it is not in the scope of this manual to address all regulatory requirements, we will consider some of the basics.

A. Landfarm Operation Safety Programs

The day-to-day operations at a landfarm facility can be developed by evaluating the hazards encountered in the normal workday, developing procedures to reduce those hazards and implementing those procedures through a comprehensive safety program. We can generally divide associated hazards into three broad categories: these are chemical, physical and biological. We will examine the chemical hazard first.

1. Chemical Safety

a. Employee Right to Know (29 CFR 1910.1200)

The first step in developing a safety program is to identify all chemical hazards and to ensure that all employees are informed. This means that employees have the right to know the identity of all hazardous chemicals they will encounter in the workplace, understand the health effects of exposure and know and understand how to work safely with those materials. This information must be provided in writing. Generally, there are not a great number of hazardous chemicals or materials on a composting site. However, a survey and inventory should be conducted to assure the proper Materials Safety Data Sheets are available.

The Employee Right to Know Program must include the following elements.

1. All hazardous materials in the workplace must be identified;

2. Material Safety Data Sheets (MSDS) on all identified hazardous chemicals must be prepared and placed in a notebook accessible to all employees at the site;
3. Employees must be trained on the requirements of Right–to-Know legislation, the content and purpose of MSDS; and how to access all information related to the workplace.
4. All containers at the worksite must be appropriately labeled to describe contents and have appropriate hazard warnings.
5. Employees must be trained in how to handle and manage the hazards to which they could be exposed.

b. Material Safety Data Sheet (29 CFR 1910.1200)

Materials Safety Data Sheets shall be in English, available for all hazardous materials on site and shall contain the following information:

1. The chemical manufacturer's name, address and emergency telephone number, the chemical name, trade name, and chemical formula.
2. The physical and chemical characteristics of the hazardous chemical (such as vapor pressure, flash point).
3. The physical hazards of the hazardous chemical, including the potential for fire, explosion, and reactivity.
4. The health hazards of the hazardous chemical, including signs and symptoms of exposure, and any medical conditions which are generally recognized as being aggravated by exposure to the chemical.
5. The primary route(s) of entry.

6. The OSHA permissible exposure limit, ACGIH Threshold Limit Value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet, where available.
7. Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Annual Report on Carcinogens (latest edition), or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest edition), or by OSHA.
8. Any generally applicable precautions for safe handling and use which are known to the chemical manufacturer, importer or employer preparing the MSDS, including appropriate hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks.
9. Any generally applicable control measures that are known to the chemical manufacturer, importer, or employers preparing the MSDS, such as appropriate engineering controls, work practices, or personal protective equipment.
10. Emergency and first aid procedures
11. The date of preparation of the MSDS or the date of the last change made.

c. Protection From Chemical Hazards

Once information on the chemical hazard has been obtained, the employer and employee can select the proper personal protective equipment. Hazardous materials may enter the body by inhalation (most common), ingestion, absorption through the skin or eyes, or injection.

The primary ways workers are exposed include:

1. Failure to follow proper procedures or to use appropriate personal protective equipment;
2. Inadequate knowledge of the materials;
3. Failure to decontaminate yourself or your equipment; or
4. Carelessness: unprotected contact with hazardous materials; walking through puddles or into clouds of unknown vapors; consuming food, water or smoking cigarettes contaminated by contact with gloves, equipment or unwashed hands.

2. Physical Hazards

Physical hazards abound at landfarm operations from exposure to large equipment, as well as many relatively minor injuries such as cuts, strains, sprains, bruises and abrasions. These injuries occur because of slips and falls, improper lifting, incautious backing of equipment, and improper use of hand or power tools. While these injuries are generally minor, serious injuries or deaths may result. Prolonged exposure to loud noises may permanently damage hearing. Exposure to heat and cold may cause heat stroke or frost-bite; and, can lead to indirect effects such as fatigue, dizziness, and confusion which in turn can lead to accidents, injuries, and death.

General guidelines for protection from physical hazards include:

1. Use proper protective equipment such as hearing protection, hardhats, steel-toed boots, safety glasses and gloves;

2. Maintain equipment in safe working conditions: perform regular preventive maintenance on heavy equipment, replace frayed electrical cords on hand tools, replace broken handles on shovels, rakes, hammers, etc.
3. Keep guards properly adjusted and in place on rotating and moving equipment such as power takeoffs.
4. Practice good housekeeping by keeping the work area clean and free of debris and excess water.

3. Biological Hazards

Exposure to biological hazards is always a possibility. Appropriate precautions must be taken. While a landfarm facility may seem, at first glance, free from the possibility of exposure, this may not be the case. Closer examination reveals materials such as glass, metals, used needles and other sharp objects that may offer a significant risk of puncture to the skin, thus introducing pathogenic organisms into the body. These organisms may arise from human sources that have contaminated the materials.

Wastewater landfarm operations represent an additional risk as the materials are of direct human origin and very likely to contain pathogenic organisms which have not been totally removed in the treatment process.

Additionally, the process of landfarming may encourage the growth of a number of molds and fungus that act as allergens. There is also the possibility of exposure to blood borne pathogens from injured personnel if proper precautions are not followed.

It is important that all employees are aware of the possibility of exposure and that steps are taken to reduce risk factors. As with the risk from chemical and physical hazards, selection

of the proper personal protective equipment and personal hygiene will greatly reduce the risk of biological exposure.

General guidelines for protection from biological hazards include:

1. Avoiding direct contact with suspect materials.
2. Wear latex or vinyl gloves, under work gloves, when in immediate contact with suspect materials.
3. Training for all personnel in blood borne pathogen protection.
4. Use of proper respiratory protection for personnel exposed to dust and debris in the processing of materials.
5. Employee availability to hand washing, shower and toilet facilities.

SAFETY REVIEW QUESTIONS

Study Questions

1. A safe work place is one where every attempt is made to _____ and _____ hazards and to _____ each employee in the proper procedures to manage those hazards.
2. List three reasons for maintaining the safe operation of a landfarm facility.
   a. _____
   b. _____
   c. _____
3. List the three broad general hazard categories a worker at a landfarm facility may be exposed to:
   a. _____
   b. _____
   c. _____
4. An employee has the _____ ____ _____ what hazardous materials are on worksite and trained to work _____ safely with those materials.
5. A _____ _____ _____ _____ must be available to the employee for all hazardous materials used or stored on site.
6. List three ways an employee can increase protection from physical hazards.
   a. _____
   b. _____
   c. _____

7. List three possible sources of biological hazards at a composting facility.

   a. _____

   b. _____

   c. _____

8. List four ways to protect yourself from exposure to biological hazards.

   a. _____

   b. _____

   c. _____

   d. _____

APPENDIX A

GLOSSARY

Active life – the period from the initial receipt of waste at a facility until certification of closure is received by the cabinet.

Agricultural waste – any non-hazardous waste resulting from the production and processing of on-the-farm agricultural products, including manures, pruning and crop residues.

Application – the form approved by the Cabinet for applying for a permit, including any additions, revisions or modification.

Authorized representative – the person responsible for the overall operation of a facility or an operational unit.

Available water holding capacity (AWHC) – the capacity of soils to hold water available for use by most plants. Also the difference before the moisture level at field capacity and the moisture level at wilting point expressed as inches of water per inch of soil depth.

Base flood – a flood that is equaled or exceeded once in 100 years, or has a 1 percent or greater chance of occurring.

Bedrock – the solid rock that underlies the soil.

Biological oxygen demand (BOD) – the demand for oxygen created by the ability of a waste or wastewater to support biological activity. Measured over a set time (5 days) under a specifically maintained temperature (68 F).

Cation – a positively charged ion in the soil or a solution.

Cation exchange capacity (CEC) – the sum of the exchangeable cations a soil can adsorb expressed in milliequivalents per 100 grams of soil.

Certified landfarming operator – a person who holds a valid certificate upon the successful completion of an approved training course and examination that is the individual responsible

for ensuring compliance with all permit conditions at a landfarming facility and who is reasonably available to the site.

Closure – the time at which a waste treatment, storage or disposal facility permanently ceases to accept wastes.

Compost – solid waste which has undergone biological decomposition of organic matter, been disinfected using composting or similar technologies, been stabilized to a degree which is potentially beneficial to plant growth and which is approved for use or sale as a soil amendment, artificial topsoil, growing media amendment, or similar uses.

Construction permit – a formal permit issued by the Cabinet to an owner or operator of a waste site or facility that authorizes commencement of site preparation for waste disposal.

Contamination – the degradation of naturally occurring air, water, or soil quality either directly or indirectly as a result of human activity.

Contour – growing crops in which rows and tillage operations are conducted perpendicular to the land slope direction.

Crop rotation – the sequence of crops grown on a field over a number of cropping seasons.

Denitrification – conversion of nitrate to nitrogen gas.

Disposal – the discharge, deposit, injection, dumping, spilling, leaking, or placing of any waste into or on any land or water so that waste may enter the environment or be emitted into the air or discharged into any waters.

Drainage class – classifies the frequency and duration of soil saturation or partial saturation with water.

Facility – all contiguous land, structure, and land improvements used for treating, storing, or disposing of waste.

Field capacity – the moisture content of a soil, expressed as a percentage of oven dry weight, after the gravitational, or free water has drained from the soil.

Food chain crops – includes tobacco, crops grown for human consumption, and crops grown for feed for animals whose products are consumed by humans.

Formal permit – a permit issued by the Cabinet for waste facility operations after review of the designated application form and completion of requirements by the applicant.

Fragipan – a restrictive soil layer that is extremely dense and compact but is not cemented nor high in clay content.

Generator – any person, by site, whose act or process produces waste.

Gravel – an angular or rounded rock fragment up to 3 inches in diameter.

Groundwater – water in the zone of perennial saturation below the land surface.

Hydraulic conductivity – a quantitative measure of the rate of water movement through soil.

Immobilization – conversion of a chemical element from the inorganic form to organic form by bacteria, plants or animals; or the retention on the exchange complex of charged ions.

Internal soil drainage – the downward movement of water through the soil profile.

Karst terrain – a type of topography where limestone is present and is characterized by naturally occurring closed depressions or sink holes, caves, or disrupted surface drainage, and has well developed underground solution channels formed by limestone dissolution by moving, underground water.

Landfarming – the application of waste on or just below the land surface; will not alter the land topography, and will not disturb the soil below three feet from the surface.

Legume – a crop that forms a specific association with bacteria that are capable of transforming nitrogen gas into organic compounds that can provide nitrogen requirements of the plant.

Mineralization – the biochemical conversion of nitrogen from the organic form to the inorganic form.

Minimum tillage – soil preparation for seeding a crop while leaving more than 30 percent of the land surface covered by crop residue.

Monitoring – the act of systematically inspecting and collecting data on operational parameters or on the quality of the air, soil, groundwater, or surface water.

Nitrification – the biochemical conversion of ammonium nitrogen to nitrate nitrogen.

Organic matter (soil) – the relatively resistant fraction of residues and other organic products that forms during biological decomposition in the soil.

Ped – an aggregate of individual grains of sand, silt and clay into a single unit of soil structure.

Permeability – the rate that water moves through the soil.

Permittee – any person holding a valid permit issued by the Cabinet to manage, treat, store, or dispose of waste.

pH – a number value between 0 and 14 that indicates the acidity (<7) or alkalinity (>7) of a liquid, soil or waste.

Pollutant – means and includes dredged spoil, solid, waste, incinerator residue, sewage, sewage sludge, garbage, chemical, biological or radioactive materials, heat, wrecked or

discarded equipment, rock, sand, soil, industrial, municipal or agricultural waste, and any substance resulting from the development, processing, or recovery of any natural resource.

Pores – spaces, or voids, between mineral grains and aggregates in the soil.

Proposed permit – document prepared by the Cabinet indicating the Cabinet's tentative decision to issue or deny, modify, revoke or terminate a permit.

Publicly owned treatment works (POTW) – any device or system used in the treatment (including recycling and recovery) of municipal sewage or industrial liquid wastes which is owned by the Commonwealth or a political subdivision of the Commonwealth.

Recycling – any process by which materials that would otherwise become solid waste are collected, separated, or processed and reused to use in the form of raw materials or products including refuse – derived fuel.

Residual nitrogen – nitrogen that remains in the soil after crop harvest that is either immediately available or will become available to succeeding crops.

Restrictive layer – any soil horizon that is slowly or very slowly permeable and underlies more permeable soil horizons.

Run-off – any rainwater, leachate, or other liquid that drains overland from any part of a waste facility.

Run-on – any rainwater, leachate, or other liquid that drains overland onto any part of a waste facility.

Saturated zone – that part of the earth's crust containing groundwater in which all voids, large and small, are filled with liquid.

Shrink-swell potential – the tendency of a soil to change volume due to the grain or loss of moisture with the rating in proportion to the relative change based on a given volume of soil.

Sludge – any solid, semi-solid, or liquid waste generated from a municipal, commercial, or industrial wastewater treatment plant, water supply treatment plant, or air pollution control facility exclusive of the treated effluent from a wastewater treatment plant or any other waste having similar characteristics and effects.

Soil – a natural body that develops in profile form in response to forces of climate and organisms acting on a parent material in a specific landscape position over a long period of time.

Soil amendment – anything added to the soil to improve its physical or chemical condition for plant growth.

Soil conditioner – any material added to soil to improve aggregation and the stability of structural soil aggregates.

Soil horizon – a layer of soil that is approximately parallel to the earth's surface whose descriptive characteristics are rather distinct from layers above or below.

Soil slope – the inclination of the land surface determined as feet of rise from the level per 100 feet of distance.

Soil structure – arrangement of individual grains of sand, silt, and clay into larger units called aggregates or peds and characterized by size, shape, and strength.

Soil texture – the amounts of sand, silt, and clay that make up a soil.

Solid waste – any garbage, refuse, sludge, and other discarded material (solid, semisolid, liquid, or contained gas) resulting from industrial, commercial, mining (excluding coal mining wastes,

coal mining by-products, refuse and over burden), agricultural operations, and from community activities.

Surface impoundment – a whole or partial facility which may be a natural topographic depression, manmade excavation, or diked area formed primarily of earthen materials and designed to hold liquid wastes or the free liquids from wastes which is not an injection well.

Tillage pan – a compact, dense layer of soil at the base of the surface layer of a cultivated soil.

Traffic pan – a compacted layer beneath the soil surface of a cultivated soil resulting from the cumulative effects over time of driving over the soil with heavy equipment or when soil moisture content is very high.

Treatment zone – a soil area of the unsaturated zone of a land treatment unit within which wastes are degraded, decomposed, transformed, or immobilized.

Unsaturated flow – water movement through soil when the large pores are filled with air.

Water table – the top of the zone of water saturated soil classes as either perched, apparent, or artesian.

Wilting point – moisture content of a soil at which plants can no longer extract water.

Zone of incorporation – the depth to which the soil on a landfarm is plowed, tilled, or otherwise designed to receive waste.

APPENDIX B

FORMS

ENERGY AND ENVIRONMENT CABINET

DEPARTMENT FOR ENVIRONMENT PROTECTION
DIVISION OF WASTE MANAGEMENT
200 FAIR OAKS LANE, 2ND FLOOR
FRANKFORT, KY 40601
TELEPHONE (502) 564-6717

ANNUAL LANDFARMING REVIEW
DEP7048 (3/92)

GENERAL INSTRUCTIONS

SUBMISSIONS – Complete all required information at the top of each log sheet. Application records will be inspected by the Division of Waste Management's Regional Office Personnel during landfarming field inspections.

COVER LETTER – Annual reviews must be submitted with a cover letter from the applicant including the applicant name, permit number, county, the year, proposed cropping plan, that this is an annual review, what is included (required information for subplot 1, 2, 3, …), anything that has been left out and is forthcoming or any other points that will help clarify the enclosed information. Cover letter should be signed by the ranking elected official, principal executive officer, and/or other authorized person per 401 KAR 45:030 Section 10.

SLUDGE ANALYSIS – Include originals or copies of the actual sludge analysis from the laboratory. Applicant should inform labs that sludge should be analyzed wet and analysis reported in mg/l. Conversions from mg/l to mg/kg should be calculated by dividing (1-solids/100) into mg/l.

SURFACE AND GROUNDWATER ANALYSIS – Submit the original or copies of the original lab sheets for surface and groundwater analysis (if monitoring is required by your permit), clearly designating them as either surface and groundwater and the location as to correlate with what is shown in the original application.

ANNUAL LANDFARMING REVIEW – Complete this form using an average or your sludge analysis for the year (yearly, by-yearly, quarterly or monthly) based on your sampling frequency required by your permit. You need only submit one copy of this form.

DEP7048

SLUDGE APPLICATION SUMMARY – All subplots which received sludge during the monitoring year should be listed along with the grand total sludge applied, the annual application rate per acre and the approved rate per acre.

LANDFARMING APPLICATION LOG – Begin a log sheet for each subplot by waste generator source on the date the sludge sample is submitted for analysis at the beginning of the monitoring year. Record the date of application quantity, hauler's initials and date of corresponding sludge analysis.

On the date the next sludge sample is submitted for analysis, tally the grand total sludge applied and circle the total in red. Record the total application quantity and waste generator source on the metals historical sheet, and calculate the metals loading rate using Metals Concentration Conversion Sheet for each generator of sludge hauled during the monitoring period. Record the application quantity on the Nitrogen Utilization Sheet and calculate the nitrogen loading.

Continue to use the same log sheet(s) for the entire monitoring year. If more than one sheet is needed label 1a, 1b, etc.

METALS CONCENTRATION CONVERSION SHEET – Use the appropriate sheet (wet or dry sludge) based on the type sludge applied.

METALS HISTORICAL – Record answers calculated per monitoring period and total at the bottom of sheet.

RESIDUAL NITROGEN WORKSHEET – You will need to complete this form even if it is the first year's application. Use the residual nitrogen calculated, on the worksheet for calculating application rates, but not on the nitrogen balance sheet (if first year). If sludge has been applied in the past, transfer these numbers to the nitrogen balance sheet.

NITROGEN BALANCE SHEET – See "Residual Nitrogen Worksheet" above.

WORKSHEETS FOR CALCULATING APPLICATION RATES – Complete this form using yearly averages brought over from the Landfarming Review Sheet. This sheet is used to calculate average application rate for the upcoming year for each subplot/crop.

SOIL ANALYSIS – The last page for each subplot should be the soil analysis. Submit an original or copy of the original lab sheet for the particular subplot.

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ANNUAL LANDFARMING REVIEW

LANDFARMING SLUDGE DATA

Landfarming Permit # _____ KPDES # _____

Permittees Name _____

Sludge Source _____

Address _____

City _____ State _____ Zip Code _____

SLUDGE QUALITY

1. Current yearly average sludge analysis (mean value of a sludge analysis based on sampling frequency):

   Date(s) of Sampling _____

   Type of Sample ☐ Grab ☐ Composite

   pH _____

   %Total Solid _____%

   %Volatile Solids _____%

   %Total Potassium _____ (ppm: _____)

   %Total Phosphorus _____ (ppm: _____)

   %Kjeldahl Nitrogen _____ (ppm: _____)

   % Ammonium Nitrogen (NH_4-N) _____ (ppm: _____)

   % Nitrate Nitrogen (NO_3-N) _____ (ppm: _____)

   Cadmium (Cd) _____ mg/l _____ mg/kg

   Copper (Cu) _____ mg/l _____ mg/kg

   Lead (Pb) _____ mg/l _____ mg/kg

   Nickel (Ni) _____ mg/l _____ mg/kg

   Zinc (Zn) _____ mg/l _____ mg/kg

   Chromium (Cr) _____ mg/l _____ mg/kg

   Polychlorinated Biphenyls (PCBs) _____ mg/kg

   (Submit a copy of the actual lab analysis sheets)

2. Total estimated quantity of sludge generated this year (gallons or dry tons) _____

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3. Name of Testing Laboratory _____

Mailing Address _____

City _____ State _____ Zip Code _____

Phone (___) ___-____

(*Submit only 1 copy for entire package, however these numbers are used on pages 1, 2, 3 of "Worksheet for Calculating Application Rates" for each subplot).

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SLUDGE APPLICATION SUMMARY

Frequency of Sludge Analysis: ☐ **Yearly** ☐ **Bi-Yearly** ☐ **Quarterly** ☐ **Monthly**

PERMIT NO. _____

SUB-PLOT NUMBER	GRAND TOTAL SLUDGE APPLIED (TONS OR GALLONS)	TOTAL AMOUNT PER ACRE (TONS OR GALLONS)	APPROVED RATE PER ACRE (TONS OR GALLONS)

***ONLY INCLUDE ONE COPY FOR THE ENTIRE PACKAGE**

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LANDFARMING APPLICATION LOG

WASTE GENERATOR SOURCE: ______________________________

SUB-PLOT NUMBER: ____________________ **ACREAGE:** ____________________

MONITORING YEAR: ______________ **PERMIT NUMBER:** ____________________

DATE	APPLICATION QUANTITY	HAULER’S INITIALS	DATE OF ANALYSIS

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METALS CONCENTRATION CONVERSION

LIQUID SLUDGE

Permit Number ________________________ **Sub-Plot Number** ______________________

Cd _____ mg./1x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Cd Applied

Cu _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Cu Applied

Pb _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Pb Applied

Ni _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Ni Applied

Zn _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Zn Applied

Cd _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Cd Applied

Cu _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Cu Applied

Pb _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Pb Applied

Ni _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Ni Applied

Zn _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Zn Applied

Cd _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Cd Applied

Cu _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Cu Applied

Pb _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Pb Applied

Ni _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Ni Applied

Zn _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Zn Applied

Cd _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Cd Applied

Cu _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Cu Applied

Pb _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Pb Applied

Ni _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Ni Applied

Zn _____ mg./1 x 8.34 x (_____ gal/1,000,000 gal.) = _____ lbs. of Zn Applied

****Lbs. of metal applied ÷ Subplot acreage = Lbs./ of metal/acre****

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METALS CONCENTRATION CONVERSION

Dry Sludge

Permit Number ________________________ **Sub-Plot Number** ________________________

Cd _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Cd Applied

Cu _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Cu Applied

Pb _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Pb Applied

Ni _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Ni Applied

Zn _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Zn Applied

Cd _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Cd Applied

Cu _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Cu Applied

Pb _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Pb Applied

Ni _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Ni Applied

Zn _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Zn Applied

Cd _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Cd Applied

Cu _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Cu Applied

Pb _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Pb Applied

Ni _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Ni Applied

Zn _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Zn Applied

Cd _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Cd Applied

Cu _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Cu Applied

Pb _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Pb Applied

Ni _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Ni Applied

Zn _____ mg./kg x _____ tons sludge x .002 = _____ lbs. of Zn Applied

****Lbs. of metal applied ÷ subplot acreage = Lbs. of metal/acre****

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RESIDUAL NITROGEN WORKSHEET
TABLE 1
Residual Nitrogen

	Organic Nitrogen Content of Sludge					
	2.0	2.5	3.0	3.5	4.0	4.5
Years Since Last Application	**Lbs. N released per ton of sludge applied**					
1	1.0	1.2	1.4	1.7	1.9	2.2
2	0.9	1.2	1.4	1.6	1.8	2.1
3	0.9	1.1	1.3	1.5	1.7	2.0

Calculations should be done for each sub-plot which has received sludge

One year ago:

Lbs. of Nitrogen released per ton of sludge X tons of sludge applied = Residual N (one year)

_____ X _____ = _____ Residual N (one year)

Two years ago:

Lbs. of Nitrogen released per ton of sludge X tons of sludge applied = Residual N (two years)

_____ X _____ = _____ Residual N (two years)

Three years ago:

Lbs. of Nitrogen released per ton of sludge X tons of sludge applied = Residual N (three years)

_____ X _____ = _____ Residual N (three years)

Total Residual Nitrogen:

Residual N (one year) + Residual N (two years) + Residual N (three years) = Total Residual Nitrogen

_____ + _____ + _____ = _____ Total Residual Nitrogen

NOTE: TO CALCULATE RESIDUAL NITROGEN FOR YEAR 2 AND 3 YOU MUST FIND THE ORGANIC NITROGEN CONTENT OF SLUDGE FROM EACH YEAR. REFER TO YOUR PREVIOUS ANNUAL REVIEW.

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WORKSHEET FOR CALCULATING APPLICATION RATES

SUBPLOT # _____ **CROP** _____

SLUDGE COMPOSITION (Parameter in ppm ÷ 10,000 = %)

Total Kjeldahl Nitrogen (TKN) _____ ÷ 10,000 = _____ %

Ammonium Nitrogen (NH_4-N) _____ ÷ 10,000 = _____ %

Nitrate Nitrogen (NO_3-N) _____ ÷ 10,000 = _____ %

Total Phosphorus _____ ÷ 10,000 = _____ %

Total Potassium _____ ÷ 10,000 = _____ %

1. Percent Available Organic Nitrogen = (%TKN) – (%NH_4-N) – (%NO_3-N)

   _____ = (_____) – (_____) – (_____)

2. Available Nitrogen in waste:

   (a) Incorporation:

   (%NH_4N X 20) + (%NO_3N X 20) + (% available organic N X 4) = lbs. available N/ton

   (_____ X 20) + (_____ X 20) + (_____ X 4) = _____ lbs. available N/ton

   (b) Surface Application:

   (%NH_4N X 10) + (%NO_3N X 20) + (% available organic N X 4) = lbs. available N/ton

   (_____ X 10) + (_____ X 20) + (_____ X 4) = _____ lbs. = _____ lbs. available N/ton

3. Residual Nitrogen (N): _____

   (Calculated Residual N by utilizing the formulas found on the Residual N worksheet)

4. Annual Application Rate:

   (a) (Crop N requirement – Residual N)/Acre ÷ lbs. available N/ton = Dry Tons/acre

   _____ - _____) ÷ _____ = _____ Dry Tons/acre

   (b) 0.44 lbs. of available Cd/acre ÷ (mg./kg of Cd in sample X 0.002 = Dry Tons/acre

   _____ ÷ (_____ X 0.002) = _____ Dry Tons/acre

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Annual Application Rate: (LOWER of (a) or (b))

Annual Application Rate = _____

5. Conversion Formula: Dry Tons to Wet Gallons

   (Tons of sludge X 2000) ÷ (8.34 X % solids in the sludge/100) = wet gallons/acre

   (_____ X 2000) ÷ (8.34 X _____) = _____ wet gallons/acre

6. Additional Phosphorus and Potassium needed:

   (a) Phosphorus (P_2O_5) in waste:

   Tons waste/acre (from 4a or 4b) X % P in waste X 45.8 = lbs. (P_2O_5) added/acre

   _____ X _____ X 45.8 = _____ lbs. (P_2O_5) added/acre

   (b) Additional (P_2O_5) fertilizer needed:

   Total phosphorus (P_2O_5) needed/acre - P_2O_5 added from sludge = lbs. P_2O_5 /acre

   _____ - _____ = _____ lbs. of additional P_2O_5 needed/acre

   * A negative answer means no additional P_2O_5 fertilizer is needed.

   (c) Potassium (K_2O) in waste:

   Tons waste (from 4a or 4b)/ acre X % K in waste X 24 = lbs. K_2O added/acre

   _____ X _____ X 24 = _____ lbs. K_2O added/acre

   (d) Additional K_2O fertilizer needed:

   Total K_2O needed/acre - K_2O added from sludge = lbs. K_2O/acre

   _____ - _____ = _____ lbs. of additional/K_2O needed/acre

   *A negative answer means no additional K_2O fertilizer is needed.

**Nitrogen Required – (lbs. available N/ton X maximum tons waste to be applied/acre) = lbs. of additional fertilizer nitrogen applied. Additional nitrogen may be needed by fertilization if the annual application rate is limited by cadmium.

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7. Maximum Amount of Waste Allowable per Acre:

Obtain maximum amount of Pb, Cd, Cu, Ni and Zn allowed based on the Cation Exchange Capacity of the soil from 401 KAR 45:100 Section 10(23). If sludge has previously been applied, calculate the remaining lifetime limits by subtracting the total amount of each metal applied from the maximum allowed found in 401 KAR 45:100 Section 10(23).

Cadmium (Cd):

Maximum Cd allowable/acre ÷ (dry mg/kg of Cd in sample X 0.002) = tons waste/acre

_____ ÷ (_____ X 0.002) = _____ tons waste/acre

Copper (Cu):

Maximum Cu allowable/acre ÷ (dry mg/kg of Cu in sample X 0.002) = tons waste/acre

_____ ÷ (_____ X 0.002) = _____ tons waste/acre

Lead (Pb):

Maximum Pb allowable/acre ÷ (dry mg/kg of Pb in sample X 0.002) = tons waste/acre

_____ ÷ (_____ X 0.002) = _____ tons waste/acre

Nickel (Ni):

Maximum Ni allowable/acre ÷ (dry mg/kg of Ni in sample X 0.002) = tons waste/acre

_____ ÷ (_____ X 0.002) = _____ tons waste/acre

Zinc (Zn):

Maximum Zn allowable/acre ÷ (dry mg/kg of Zn in sample X 0.002) = tons waste/acre

_____ ÷ (_____ X 0.002) = _____ tons waste/acre

Life in Number of Years = Lowest amount from Item 7 in tons/acre ÷ tons waste applied/acre/year

8. Number of years that waste can be applied: _____

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CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for such violations".

Signature of Authorized Agent _____ Date _____

Name of Authorized Agent _____

Title _____

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N O T I C E

* * * * * * *

Page 3 of DEP form 7048 (3/92), "Annual Landfarm Review", references a sheet entitled "Metals Historical" and another entitled "Nitrogen Balance Sheet"; however, those sheets were not included in the original printing of form 7048. Those sheets follow this notice, and include a sheet for metals data for the past year (Metals Historical: Annual), a year by year summary of metals data for the facility (Metals Historical: Lifetime), and a sheet with nitrogen calculations (Nitrogen Balance Sheet). These sheets are to be completed in accordance with the directions on page 3 of the form.

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NITROGEN BALANCE SHEET
SUB-PLOT NUMBER: ____

Permit Holder Name: _____ Permit #: _____
Total Sub-Plot Acreage: _____ Reporting Year: _____

(1) Date From-To	(2) Grant Total Sludge Applied Dry Ton	(3) Sludge Quantity Applied Dry Ton/Acre	(4) Sludge Nitrogen Applied lbs./acre From 2a or 2b on Worksheet for Calculating Application Rates Column #3	(5) Fertilizer Nitrogen Applied lbs./acre	(6) Residual Nitrogen Remaining Lbs./acre (from Previous Residual Nitrogen Worksheet Years 1 & 2)	(7) Total Nitrogen Available lbs./acre (the sum of columns 4, 5 & 6)	(8) Crop(s) Grown	(9) Yield tons/acre or by/acre	(10) Date(s) Harvested or Grazed	(11) Nitrogen Removed lbs./acre	(12) Nitrogen Remaining lbs./acre (Column #7 minus Column #11)

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METALS HISTORICAL
LIFETIME
SUB-PLOT NUMBER: ____

Permit Holder Name: _____ Permit No.: _____
Total Sub-Plot Acreage: _____ Reporting Year: _____

Year	Wastewater Source	Total Sludge Applied (Gallons or Tons)	Amount per Acre (Gallons or Tons)	Total Lbs. Applied (From Metals Conversion Sheet)					Rate in Lbs./Acre (Divide total lbs. by sub-plot acreage)					Soil pH (from annual soil analysis)	Lime Applied (tons/acre/ year)
				Cd	Cu	Pb	Ni	Zn	Cd	Cu	Pb	Ni	Zn		
	Grand Total														

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METALS HISTORICAL
ANNUAL
SUB-PLOT NUMBER: ____

Permit Holder Name: _____ Permit No.: _____
Total Sub-Plot Acreage: _____ Reporting Year: _____

Date From-To	Wastewater Source	Total Sludge Applied (Gallons or Tons)	Amount per Acre (Gallons or Tons)	Total Lbs. Applied (From Metals Conversion Sheet)					Rate in Lbs./Acre (Divide total lbs. by sub-plot acreage)					Soil pH (from annual soil analysis)	Lime Applied (tons/acre/ year)
				Cd	Cu	Pb	Ni	Zn	Cd	Cu	Pb	Ni	Zn		
	Grand Total														

ENERGY AND ENVIRONMENT CABINET

DEPARTMENT FOR ENVIRONMENT PROTECTION
DIVISION OF WASTE MANAGEMENT
200 FAIR OAKS, 2ND FLOOR
FRANKFORT, KY 40601
TELEPHONE NUMBER 502-564-6716

Annual Report for a Class I Solid Waste Land Application
DEP Form 7064 (6/99)

GENERAL INSTRUCTIONS

1. **APPLICABILITY – This form must be completed and submitted to the Cabinet.**
2. **ASSISTANCE – Questions regarding this form may be directed in writing to the Division of Waste Management, Solid Waste Branch at the address listed above or by calling 502-564-6716.**
3. **SUBMISSION – Please type or print legibly in permanent ink. Submit the original and two (2) copies of the completed form to the Division of Waste Management at the address listed above. If an item is not applicable to your facility write "N/A" in the space provided.**
4. **FEES – There are no fees associated with this application.**
5. **LAWS AND REGULATIONS – Applicants are expected to understand and comply with all laws and regulations applicable to the facility.**

Statutes and regulations may be viewed online at the following website address: http://www.lrc.ky.gov/search.htm

Solid waste application forms are available at the following website address: http://www.waste.ky.gov/forms/

To assist you in the submittal of a complete and accurate application, the division has identified the most common errors made in the review process. These errors are listed below for your convenience.

1. **Failure to complete the application.**
2. **Failure to comply with public notice requirements. See KRS 224.40-310 and 401 KAR 47:140, Section 7 for more information.**
3. **Failure to comply with Financial Assurance requirements. If the existing financial assurance is insufficient to fully cover current closure and post-closure costs, updates will be required.**
4. **Failure to properly sign and notarize the application. An individual with signature authority for the applicant as defined by KRS 224.01-010(44) and 401 KAR 47:160 must sign and notarize the appropriate signature sections of the application.**
5. **Failure to provide appropriate, fully completed attachments. Maps, drawings, narratives or any attachments that lack sufficient detail or drawings that are not signed, dated and sealed by a professional engineer or geologist may cause delays in the review and approval of the application.**

ANNUAL LANDFARMING REPORT

Year Ending December 31, _____ Permit Number _____ - _____

1. Facility Name _____
2. Mailing Address _____
3. City _____ 4. State _____ 5. Zip _____ 6. County _____
7. Phone Number (____) _____ - _____ 8. Fax Number (____) _____ - _____
9. Certified Operator _____ 10. Certification Number _____
11. Waste Characterization:

	Wet Weight	**Dry Weight**
pH	_____SU	
Total Solids Content	_____%	
Volatile Solids Content	_____%	
Total Phosphorous	_____ppm	_____ppm
Total Potassium	_____ppm	_____ppm
Total Nitrogen (TN)	_____ppm	_____ppm
Ammonium Nitrogen (NH4-N)	_____ppm	_____ppm
Cadmium	_____mg/L	_____mg/kg
Copper	_____mg/L	_____mg/kg
Lead	_____mg/L	_____mg/kg
Nickel	_____mg/L	_____mg/kg
Zinc	_____mg/L	_____mg/kg

12. List and quantify additional parameters if required by your registration.

Parameter	**Concentration**	
	mg/L	**mg/kg dry wt.**

NOTE: The results reported above are the average of analyses taken during the reporting year. Waste should be analyzed as collected. **Do not conduct a separate analysis of a dried sample for the dry weight values.** Dry weight values (mg/kg) are derived using the following equation: mg/L ÷ (% Solids) = mg/kg dry weight.

13. The annual waste application limit is: _____ ☐ tons per acre
☐ gallons per acre

14. The waste parameter limiting annual application rates is: _____
(nitrogen, cadmium, other designated by cabinet)

If no nutrient, pollutant or physical characteristic limits the annual application rate, check here ☐.

15. The waste parameter limiting the lifetime application limit is: _____
(Cu, Cd, Pb, Ni, Zn, other)

If no nutrient, pollutant or physical characteristic limits the lifetime application amount, check here ☐.

NOTE: The annual limits based on nitrogen and cadmium and the lifetime application limits for cadmium, copper, lead, nickel and zinc are specified in 401 KAR 48:200. Refer to the conditions listed in your letter of registration for any other parameters which may limit the annual rate or lifetime limit as required by the cabinet. Where no limits are established, the operator must ensure the application rates do not cause waste to run off the permitted subplot area or prolonged saturated soil conditions contributing to soil compaction or poor crop performance.

16. Attach copies of all laboratory analysis reports for waste and soil analyses.

17. Attach copies of laboratory analysis reports for surface water sampling if required by your registration.

Pursuant to 401 KAR 47:160, Section 6(4), "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitted false information, including the possibility of fine and imprisonment for such violations."

_____ _____
SIGNATURE DATE

This certification clause shall be signed by the responsible person(s) described in 401 KAR 47:160, Section 6(1) and/or (2) and is required by 401 KAR 47:160, Section 6(4). This clause may be incorporated into a cover letter and attached to this submission. This clause shall accompany <u>every</u> report/application submitted to this office.

Subplot Application Summary

Enter the name of the subplot as it appears in the application for this registration. Complete a block for each permitted subplot, whether or not waste was applied during the reporting year. If no waste was applied, complete only the subplot name and enter zero for the volume applied. If more than one type of crop is harvested from a subplot during the reporting year, complete a separate report block for each harvested crop. Make additional copies as needed.

Subplot Name or Number	Subplot Acreage	Volume Applied Per Acre ☐ Tons ☐ Gallons	Application Method ☐ Injected or Incorporated ☐ Surface Applied	
Date of Last Application	Crop	Harvest Yield Per Acre, if applicable	Harvest Date	Grazing Dates, if applicable
Total Volume Applied in Reporting Year ☐ Tons ☐ Gallons	Total of All Applications To Date ☐ Tons ☐ Gallons	Subplot Life Remaining Years		

Subplot Name or Number	Subplot Acreage	Volume Applied Per Acre ☐ Tons ☐ Gallons	Application Method ☐ Injected or Incorporated ☐ Surface Applied	
Date of Last Application	Crop	Harvest Yield Per Acre, if applicable	Harvest Date	Grazing Dates, if applicable
Total Volume Applied in Reporting Year ☐ Tons ☐ Gallons	Total of All Applications To Date ☐ Tons ☐ Gallons	Subplot Life Remaining Years		

Subplot Name or Number	Subplot Acreage	Volume Applied Per Acre ☐ Tons ☐ Gallons	Application Method ☐ Injected or Incorporated ☐ Surface Applied	
Date of Last Application	Crop	Harvest Yield Per Acre, if applicable	Harvest Date	Grazing Dates, if applicable
Total Volume Applied in Reporting Year ☐ Tons ☐ Gallons	Total of All Applications To Date ☐ Tons ☐ Gallons	Subplot Life Remaining Years		

Subplot Name or Number	Subplot Acreage	Volume Applied Per Acre ☐ Tons ☐ Gallons	Application Method ☐ Injected or Incorporated ☐ Surface Applied	
Date of Last Application	Crop	Harvest Yield Per Acre, if applicable	Harvest Date	Grazing Dates, if applicable
Total Volume Applied in Reporting Year ☐ Tons ☐ Gallons	Total of All Applications To Date ☐ Tons ☐ Gallons	Subplot Life Remaining Years		

Subplot Name or Number	Subplot Acreage	Volume Applied Per Acre ☐ Tons ☐ Gallons	Application Method ☐ Injected or Incorporated ☐ Surface Applied	
Date of Last Application	Crop	Harvest Yield Per Acre, if applicable	Harvest Date	Grazing Dates, if applicable
Total Volume Applied in Reporting Year ☐ Tons ☐ Gallons	Total of All Applications To Date ☐ Tons ☐ Gallons	Subplot Life Remaining Years		

Landfarming Calculations Worksheet

Section 1. Limiting Parameters

The following equations are used to determine the amount of an annual or lifetime application limiting parameter:

1. Dry Weight Conversion:

   a) For facilities reporting in gallons:

   Gallons applied per acre x 8.34 lbs/gal ÷ 2000 lbs/ton x $\frac{\%\ \text{Solids}}{100}$ = dry wt. tons/acre

   Example: The dry tons equivalent of 54,000 gallons of a 1.2% solid waste is 2.7 tons/acre

   b) For facilities reporting in tons:

   Tons applied per acre x $\frac{\%\ \text{solids}}{100}$ = dry wt. tons/acre

   Example: The dry tons equivalent of 18 tons of a 24% solid is 4.3 tons/acre

2. Calculation of annual amount of a limiting parameter:

   Mg/kg dry weight x dry wt. tons of waste applied in reporting year x .002 = lbs applied

   Example: 6.7 dry tons per acre with cadmium at 9.5 mg/kg dry wt. is 0.13 lbs Cd/acre

The calculations above must be performed first to calculate lifetime limits below. With the exception of nitrogen, which is calculated in Sections 2 and 3 of this worksheet, cadmium is the only parameter with an annual limit established by regulation. For any additional parameters for which annual limits were established by the cabinet as a condition for operation of the landfarming facility, refer to your registration.

For landfarming facilities with a daily application limit based on Biological Oxygen Demand (BOD), perform the calculations above using the maximum daily application rate during the reporting year.

3. Lifetime or cumulative limits. For cadmium, copper, lead, nickel and zinc, refer to 401 KAR 48:200 Section 6(23). For any additional parameters for which lifetime limits were established by the cabinet as a condition of operation of the landfarming facility, refer to your registration. The lifetime limit is the sum of all annual application amounts, as calculated above. You must keep a running total for all lifetime limiting parameters for each subplot and have these records available for inspection by the cabinet.

4. Calculation of remaining subplot use in years based on lifetime limits: **Determine the most limiting parameter and enter the years remaining based on that parameter in the Subplot Application Summary.**

   a) Subtract the sum of all applications through the reporting year from the lifetime limit in 401 KAR 48:200 or your registration.

   b) Divide the remaining amount by the annual amount applied based on the current reporting year.

   Example: With the addition of 0.13 lbs. cadmium in the current reporting year, the subplot sum total of cadmium applied is now 2.3 lbs/acre. The allowable limit is 4.4 lbs/acre Cd:

   4.4 lbs. – 2.3 lbs. = 2.1 lbs. Cd. ÷ 0.13 lbs/yr = 16 years

Section 2. Nitrogen Balance

As required by 401 KAR 48:200 Section 8 (24), the amount of nitrogen land applied must not exceed the nitrogen utilization rate of the crop being grown. Use the actual percentage value, not the decimal equivalent, for all calculations (i.e., if Total Solids Content is 1.2%, use 1.2, **not** 0.012). All values entered on this worksheet must be the same as the values listed in the Waste Characterization section of the application or annual report. Include a copy of the completed Nitrogen Balance worksheet with the Application for a Class I Solid Waste Landfarm and Annual Landfarming Reports.

For the first year of application of waste, the Volume Applied per Acre entered on the Subplot Application Summary sheet must show the lbs. PAN determined above times the total volume applied in the reporting year did not exceed the crop nitrogen recommendation obtained from UK Extension Bulletin AGR 1 or the county extension service. If the amount of Plant Available Nitrogen applied from the waste is less than the crop recommendation, use the value obtained to determine additional fertilizer nitrogen needed by the crop. Make allowance for subplots on which the previous crop was a legume, based on extension service recommendations and for residual nitrogen, as described in the next section of this worksheet.

1. Percent Organic Nitrogen: Organic N is derived by subtracting the sum of Ammonia and Nitrate N from Total N.

   _____ - (_____ + _____) = _____% Organic N
   % Total Nitrogen % Ammonia N % Nitrate N

2. a) Plant Available Nitrogen (PAN), Incorporated Waste:

   _____ + _____ + _____ = _____% PAN
   % Ammonium N % Nitrate N (% Organic N x 0.4)

   b) Plant Available Nitrogen, Surface Applied Waste:

   _____ + _____ + _____ = _____% PAN
   (% Ammonium N x 0.5) % Nitrate N (% Organic N x 0.4)

3. a) Pounds of Plant Available Nitrogen, Per 1,000 gallons, for facilities reporting in gallons.

   _____ x 83.4 = _____ lbs. PAN/1,000 gallons
   % PAN

   b) Pounds of Plant Available N per Ton, for facilities reporting in tons.

   _____ x 20 = _____ lbs. PAN/ton
   % PAN

4. Determine the total N/acre for each subplot based on the volume applied, the total residual N/acre from residual nitrogen calculations, nitrogen from previous legume crop and any nitrogen added as fertilizer.

Section 3. Residual Nitrogen

Residual Nitrogen is the amount of Organic N mineralized from previous years' waste applications. Use the percent (not the decimal equivalent) Organic Nitrogen calculations from Nitrogen Balance Worksheets from the corresponding previous years. Calculate the Total Residual N for each subplot according to the volume of waste applied in each of the three previous years and include the amount in the annual nitrogen balance calculations for each subplot.

1. For facilities reporting in gallons:

   a) One year prior to the reporting year:

   _____ x 16.7 = _____ Residual N/1,000 gallons
   % Organic N

   b) Two years prior to reporting year:

   _____ x 8.34 = _____ Residual N/1,000 gallons
   % Organic N

   c) Three years prior to reporting year:

   _____ x 4.17 = _____ Residual N/1,000 gallons
   % Organic N

2. For facilities reporting in tons:

   a) One year prior to the reporting year:

   _____ x 4 = _____ Residual N/ton
   % Organic N

   b) Two years prior to reporting year:

   _____ x 2 = _____ Residual N/ton
   % Organic N

   c) Three years prior to reporting year:

   % Organic N =_____ Residual N/ton

3. Determine the total residual N/acre for each subplot based on the volume applied in the corresponding year. Add the total residual N/acre to the nitrogen calculations for the subplot.

APPENDIX C

REGULATIONS

401 KAR 45:090. Special waste operator certification.

RELATES TO: KRS 224.01, 224.10, 224.40, 224.50

STATUTORY AUTHORITY: KRS 224.10-100, 224.40-100, 224.40-305, 224.40-605, 224.50-760

NECESSITY, FUNCTION, AND CONFORMITY: KRS Chapter 224 requires the cabinet to adopt administrative regulations for the management, processing, and disposal of special wastes. KRS 224.40-305 requires persons who establish, conduct, operate, maintain or permit the use of a waste site or facility to obtain a permit. This chapter establishes the permitting standards for special waste sites or facilities, and the standards applicable to all special waste sites or facilities. This administrative regulation establishes the program for education, testing, and certification of operators of special landfarming sites or facilities in accordance with KRS 224.40-605.

Section 1. Applicability. (1) The requirements of this administrative regulation apply to all special waste landfills, landfarms, and composting facilities operating under formal permits, as identified in 401 KAR 45:020, Section 2(1)(a) and (b).

(2) The owner or operator shall ensure that all technical operations at the special waste site or facility are conducted by or under the direction of an individual with a valid certification under this administrative regulation. The landfill, landfarming, or composting operator shall be reasonably available at the site or facility during operation.

(3) The certified operator shall ensure that all operations are conducted in compliance with this chapter.

(4) A special waste site or facility permit may be revoked or subject to other enforcement actions upon violation of the requirements of this administrative regulation.

Section 2. Transition of Certification. (1) Persons holding a valid certification for landfill manager, landfill operator, and landfarming operator under 401 KAR 47:070 shall be deemed to hold a valid certification under this chapter until the certification expires. At the time a certification expires, the certificate holder shall obtain special waste certification under this administrative regulation.

(2) Persons operating a special waste landfill who were not previously certified to operate a residual landfill under 401 KAR Chapter 47 shall obtain certification under this chapter within one (1) year of the effective date of this administrative regulation.

(3) Persons operating a special waste composting or landfarming site or facility shall obtain certification within one (1) year of the effective date of this administrative regulation.

Section 3. General Provisions for Landfills. (1) Each special waste landfill shall have a landfill operator certified in accordance with this administrative regulation.

(2) No special waste landfill shall operate in the absence of a certified operator without the appointment of an interim operator in accordance with Section 11 of this administrative regulation.

Section 4. General Provisions for Landfarming and Composting Facilities. (1) Each landfarming or composting facility shall have an operator certified in accordance with this administrative regulation.

(2) No landfarming or composting facility shall operate in the absence of a certified operator without the appointment of an interim operator in accordance with Section 11 of this administrative regulation.

Section 5. Application for Certification. (1) Persons desiring to be certified shall submit an application at least thirty (30) days prior to the scheduled training class. Applicants for training and examination shall use form DEP 6031 entitled "Application for Certification" (March 1992). The requirements contained in the

application for certification are incorporated in this administrative regulation by reference. The application may be obtained from the Division of Waste Management, 14 Reilly Road, Frankfort, Kentucky 40601, (502) 564-6716, between the hours of 8 a.m. to 4:30 p.m., Eastern Time, Monday through Friday.

(2) The cabinet shall review applications and supporting documents, determine the eligibility of the applicant for examination, and notify the applicant of the determination.

(3) No person shall be eligible for examination for certification unless that person completes the appropriate training course provided by the cabinet, unless an alternative training program is accepted by the cabinet in accordance with Section 6 of this administrative regulation.

Section 6. Training Course Requirements. (1) The cabinet shall provide training courses for individuals desiring to become certified. All applicants for certification shall be required to attend a training course provided by the cabinet, unless alternate training is accepted under subsection (3) of this section.

(2) The training course shall address the technical and legal aspects of the facility type for which operator certification is sought.

(a) The training course for landfill operators shall include:

1. Permit application requirements for special waste landfills, including technical and administrative requirements;
2. Waste characterization;
3. Chemical and biologic reactions associated with the waste;
4. Hydrogeologic and engineering factors associated with the facility;
5. Operational requirements and achieving compliance with 401 KAR 30:031;
6. Duties and responsibilities associated with landfill management;
7. Requirements of this chapter as they apply to facility operation, including environmental monitoring, operations requirements, and maintaining compliance with 401 KAR 30:031;
8. Evaluating site suitability to receive wastes;
9. Environmental considerations in preventing violations of this chapter;
10. Maintaining equipment; and
11. Facility safety.

(b) The training course for landfarm and composting operators shall include:

1. Requirements of this chapter as they apply to facility operation and management;
2. Wastewater treatment processes;
3. Waste characterization;
4. Chemical and biological reactions associated with the waste;
5. Landfarming design and management;
6. Permit application requirements for special waste landfarms;
7. Environmental considerations in preventing violations of this chapter;
8. Achieving and maintaining compliance with 401 KAR 30:031;
9. Evaluating site suitability to receive waste;
10. Maintaining equipment;
11. Facility safety; and
12. Duties and responsibilities associated with operating a landfarm.

(3) The cabinet may accept alternate training courses, provided they result in a level of competence equivalent to that of participation in the cabinet's training course. It shall be the applicant's responsibility to submit documentation as the cabinet requires for an equivalency judgement of the alternate training course. This information shall contain at a minimum the following specifics: the course name; sponsoring agency; the date, location, and beginning and ending times of the course; a summary of the course content of sufficient detail to determine relevance and quality of the course; and a copy of the certificate received.

Section 7. Training and Examinations. (1) After training is complete, time shall be set aside for the purpose of examinations to determine the knowledge and ability of the applicant.

(2) Separate examinations shall be prepared to cover basic differences in the duties and responsibilities for the operation of each category of special waste site or facility.

(3) Applicants who fail to pass an examination may reapply for the examination at a regularly scheduled examination or by appointment with the cabinet. The cabinet shall require the applicant to attend the training session again if the applicant fails to pass the examination in three (3) attempts.

Section 8. Education and Equivalencies. (1) All applicants shall be evaluated by the cabinet as to education and experience as related to the appropriate category of special waste site or facility.

(2)(a) Applicants for landfill operator shall have completed high school, by graduation or by obtaining an equivalency certificate, and shall have a minimum of one (1) year of experience at a landfill facility.

(b) If an applicant for landfill operator does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the number of years of experience in operating a landfill or experience in a related field such as heavy equipment operator, road construction, surface mining.

(3)(a) Applicants for landfarming or composting operator shall have completed high school, by graduation or by obtaining an equivalency certificate, and shall have a minimum of one (1) year of experience at a landfarming or composting facility.

(b) If an applicant for landfarming or composting operator does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the number of years of experience in operating a landfarming facility or experience in a related field such as wastewater treatment or water treatment in determining eligibility for examination on a year-for-year basis.

Section 9. Issuance of a Certificate. (1) Certification may be issued to individuals upon meeting the minimum education requirements, work experience, and the course work requirements of this administrative regulation and passing the examination in accordance with Section 5 of this administrative regulation.

(2) Certification shall not be valid if obtained through fraud, deceit, or the submission of inaccurate data.

Section 10. Issuance of Certificate. (1) A certification shall be issued for a period of five (5) years, at the end of which the certification shall expire, unless renewed. Renewal procedures and requirements shall be the same as those for a new certification.

(2) The certification of an operator whose employment at a special waste site or facility terminates shall remain valid until expiration or revocation of certification.

(3) Certificates shall be carried on the person of the certified operator during working hours at the facility, or shall be prominently displayed at the facility office.

(4)(a) The cabinet may revoke the certification of an operator if the operator:

1. Has practiced fraud or deception;
2. Has failed to perform his duties under this chapter;
3. Has failed to use reasonable care and judgement in performance of his duties under this chapter; or
4. Has knowingly or willfully violated the requirements of this chapter.

(b) Individuals who have had their certification revoked shall be ineligible for future recertification.

Section 11. Interim Operators. (1) The permittee shall be responsible for actions of an interim operator. The permittee shall notify the cabinet in writing if the special waste site or facility will not have a certified operator for more than fourteen (14) consecutive operating days.

(2) Consecutive operating days, as used in subsection (1) of this section, shall be determined as any days:

(a) When the special waste site or facility accepts waste, operates equipment, or otherwise performs the business of special waste management; and

(b) That occur in sequence, regardless of whether nonoperating days such as weekends or holidays fall in between.

(3) The notification required by subsection (1) of this section shall be provided at least ten (10) days prior to an anticipated absence, and immediately upon discovery of an unanticipated absence. The notification shall contain:

(a) The name, address, and qualifications of the interim operator;

(b) The length of time for which the permittee seeks to have an interim operator rather than a certified operator; and

(c) Reasons for replacement of the certified operator with an interim operator.

(4) The cabinet shall evaluate the qualifications of the designated interim operator and shall notify the permittee of the cabinet's determination in writing within thirty (30) days of receipt of the permittee's notice. The determination shall:

(a) Approve, conditionally approve, or deny the permittee's request for designation of the interim operator;

(b) Identify the length of time an interim operator may operate the special waste site or facility; and

(c) Specify conditions as appropriate to the site and the interim operator's qualifications.

(5) An interim operator shall obtain certification under this administrative regulation within fifteen (15) months of becoming an interim operator.

(6) The cabinet may revoke the appointment of an interim operator in accordance with Section 10(4)(a) of this administrative regulation. Revocation shall render the person ineligible for operator certification under Section 10(4)(b) of this administrative regulation.

Section 12. Fees. (1) Fees for application for certification shall be:

(a) $125 for application for certification as a landfill operator;

(b) $125 for certification as a landfarming or composting operator;

(c) Fifty (50) dollars for certification by reciprocity for all categories of operator; and

(d) $100 dollars for attendance at the certification training without taking the examination.

(2) Fees shall accompany applications and shall not be returned to those who do not qualify for a certificate. (18 Ky.R. 3094; Am. 3440; eff. 6-24-92.)

401 KAR 47:070. Operator certification.

RELATES TO: KRS 224.01, 224.10, 224.40, 224.43, 224.46, 224.70, 224.99
STATUTORY AUTHORITY: KRS 224.10-100, 224.40-605
NECESSITY, FUNCTION, AND CONFORMITY: KRS Chapter 224 requires the cabinet to adopt rules and administrative regulations for the management, processing or disposal of wastes. KRS 224.40-605 requires the cabinet to promulgate administrative regulations that establish standards and a certification program for operators of waste sites or facilities. This chapter establishes the permitting standards for solid waste sites or facilities, the standards applicable to all solid waste sites or facilities, and the standards for certification of operators. An overview of the permit program is found in Section 1 of 401 KAR 47:080. This administrative regulation establishes the program for education, testing, and certification of facility operators of solid waste sites or facilities.

Section 1. Definitions. The following are definitions as used in this administrative regulation:
(1) "Category of solid waste site or facility" means inert, residual, construction demolition debris, residential or contained landfill and includes landfarming facilities receiving Class I, II and III sludges or wastes.
(2) "Certificate" means a written document issued by the cabinet stating that the operator has met all requirements for certification.
(3) "Certified operator" means a solid waste site or facility operator who holds a valid certificate. The following are categories of certified operators:
(a) "Landfarming operator" means a certified operator who is the individual responsible for ensuring compliance with all permit conditions at a landfarming facility in accordance with 401 KAR 48:200, and who is reasonably available to the site;
(b) "Landfill operator" means a certified operator who is the individual responsible for the daily operating requirements identified in 401 KAR 47:120, 48,060, 48:090, or 48:170;
(c) "Landfill manager" means a certified operator who is the individual with primary responsibility for management and operation of the residential or contained or construction/demolition debris sanitary landfill to assure compliance with all permit conditions including direct responsibility for providing guidance to the landfill operator, or the permittee and the authority to commit financial resources allocated for proper operation; or
(d) "Interim operator" means the individual identified by the permittee as the replacement landfarming operator, landfill operator, or landfill manager in accordance with Section 12 of this administrative regulation.

Section 2. Applicability. (1) The requirements in this administrative regulation apply to all solid waste sites or facilities except as subsection (2) of this section provides otherwise. Each solid waste site or facility shall have at least one (1) operator certified in accordance with Section 3 (sanitary landfills) or Section 4 (landfarming facilities) of this administrative regulation, as appropriate to the category of solid waste site or facility.
(2) Residual landfills and facilities operating under a registered permit-by-rule or a permit-by-rule are excluded from the requirements of this administrative regulation, unless the cabinet requires operator certification as a condition of the permit. In deciding whether to require operator certification at a residual landfill, a site or facility with a registered permit-by-rule or a permit-by-rule, the cabinet shall consider:
(a) The characteristics of the waste stream;
(b) The characteristics of the site, including geology and hydrology; and
(c) The experience and qualifications of the operator.

(3) It shall be the responsibility of the permittee to ensure that the solid waste site or facility complies with the requirements of this administrative regulation.

Section 3. General Provisions for Landfills. (1) Each construction/demolition debris, residential and contained landfill shall have a certified operator who is a landfill operator and a landfill manager. The requirements of this subsection may be fulfilled by:

(a) One (1) individual who has been certified in accordance with Section 6 of this administrative regulation for both categories of certified operator (provided this individual meets the qualifications in Sections 1(3) and 11 of this administrative regulation); or

(b) Two (2) individuals who have been certified in accordance with Section 6 of this administrative regulation in each category of operator such that one (1) individual is certified as a landfill operator and one (1) individual is certified as a landfill manager.

(2) As provided in Section 2 of this administrative regulation, the cabinet may require as a permit condition that a residual landfill or a site or facility with a permit-by-rule or registered permit-by-rule shall have a certified operator who is a landfill operator or a landfill manager or both. The permit condition imposed shall reference all applicable operating administrative regulations and requirements for the specific category of sanitary landfill.

(3) In the event the certified operator who is the landfill operator is not physically at the facility during operating hours, either the landfill manager or an interim operator shall be designated responsible for daily site operation and shall be physically located on site. If an interim operator assumes responsibility for daily operation of the landfill, the requirements in Section 12 of this administrative regulation shall be met.

(4) In carrying out its responsibilities, the cabinet shall examine the qualifications of applicants for certification and maintain records of certification and a register of certified operators.

(5)(a) Except as provided in Section 2 of this administrative regulation, no landfill shall continue operation in the absence of a landfill operator on site for more than ten (10) consecutive operating days without appointment of a qualified interim operator in accordance with Section 12 of this administrative regulation or written approval from the cabinet.

(b) Except as provided in Section 2 of this administrative regulation, no landfill shall continue operation in the absence of a landfill manager for a period longer than thirty (30) consecutive operating days without appointment of a qualified interim operator in accordance with Section 12 of this administrative regulation or written approval from the cabinet.

Section 4. General Provisions for Landfarming Facilities. (1) Each landfarming facility shall have a landfarming operator certified in accordance with Section 6 of this administrative regulation.

(2) No landfarming facility shall continue operation in the absence of a landfarming operator for a period longer than five (5) consecutive working days without appointment of a qualified interim operator in accordance with Section 12 of this administrative regulation or written approval from the cabinet.

Section 5. Application for Certification. (1) An individual desiring to be certified shall file an application on a form provided by the cabinet at least thirty (30) days before beginning training for a scheduled examination.

(2) The applicant shall submit all information needed to determine eligibility of the applicant for examination and certification.

(3) The cabinet shall review applications and supporting documents, determine the eligibility of the applicant for examination and notify the applicant of the determination.

(4) No person shall be eligible for examination for certification unless that person completes the appropriate training class or classes provided by the cabinet, unless an alternative training program or

certification program is accepted by the cabinet in accordance with Section 7(6) of this administrative regulation.

Section 6. Training Classes and Examinations. (1) The cabinet will provide training classes for the certified operator.

(2) Training sessions will be held at least annually at places and times set by the cabinet. The last day of each training session will be set aside for the purpose of examinations to determine the knowledge and ability of the applicant.

(3) Certification shall be conditioned on successful passage of a written examination, unless an alternative examination process is accepted by the cabinet.

(4) Separate examinations will be prepared to cover basic differences in the duties and responsibilities for the operation of each category of solid waste site or facility and each category of certified operator.

(5) Applicants who fail to pass an examination may reapply for the examination at a regularly scheduled examination or by appointment with the cabinet. The cabinet shall require the applicant to attend the training session again if the applicant fails to pass the examination in three (3) attempts.

(6) In the event an applicant fails to meet the requirements for certification, he may petition the cabinet for a one (1) time only "temporary hardship certification." The cabinet will then conduct an informal hearing at which evidence shall be presented by the applicant to support his hardship request. Each temporary hardship certification request shall be considered on a case-by-case basis under the following guidelines:

(a) Failure of the applicant to receive certification would leave a significant area of the state without adequate waste disposal service.

(b) The applicant has shown a good faith effort by attending all required training sessions and met all requirements except the applicant has failed in three (3) attempts to pass the examination.

(c) The applicant has shown, through cabinet inspections, a capability for satisfactory operation of the solid waste site or facility.

Section 7. Training Course Requirements. (1) All applicants for certification shall be required to attend a training course provided by the cabinet in accordance with KRS 224.844.

(2) The training course provided by the cabinet shall be designed to provide information as appropriate to the category of certified operator. At a minimum, the training course shall provide information which enables the certified operator to perform his duties in a knowledgeable and competent manner.

(3) Landfill managers shall be trained on:

(a) The requirements for permit application for the applicable category of sanitary landfill including ownership, zoning, chapter 109 district boards, geologic and hydrologic information and specific design details;

(b) Characteristics of the waste stream; the physical, chemical and biological reactions including the hydrogeologic interactions of a landfill; and measures that shall be employed to meet the environmental performance standards in 401 KAR 47:030 and all other regulatory requirements; and

(c) Specific duties expected to be performed by individuals who are wholly responsible for the requirements associated with the operation of the applicable category of sanitary landfill permitted by the cabinet. These actions include at a minimum, the commitment of resources, oversight of operating personnel, and verification that site operation is in accordance with all provisions of the permit including technical documents.

(4) Landfill operators shall be trained on the requirements contained in the solid waste administrative regulations as they apply to daily site operation duties. These duties include judging indicators regarding a site's ability to receive wastes; judging waste characteristics for disposal acceptability; employing site equipment to maintain waste compaction, cover, and surface water management on a daily basis;

maintaining equipment; maintaining site safety; and generally assuring compliance with the administrative regulations.

(5) Landfarming operators shall be trained on the Kentucky waste management program as it applies to landfarming; wastewater treatment processes; the nature and characteristics of sludges; the physical and chemical properties of sludges; landfarming design and management; environmental considerations; and the Kentucky waste management permit process. The permit process includes requirements for application, conditions for maintaining a permit in compliance with the application and administrative regulations, and amendments to the landfarming activity and associated permit.

(6) The cabinet shall provide the training course to applicants for certification. However, the cabinet may consider alternate training courses or certification programs provided they are equivalent to the content prescribed by the cabinet's training course. It shall be the applicant's responsibility to submit such documentation as the cabinet requires for an equivalency judgment of the alternate training course. This information shall contain at a minimum the following specifics: the course name; sponsoring agency; the date, location and the beginning and ending times of the course; a summary of the course content of sufficient detail to determine relevance and quality of the course; and a copy of the certificate received.

Section 8. Issuance of Certificates. (1) Upon passage of the examination the cabinet will issue a certificate to the applicant which will indicate the category of solid waste site or facility and the category of certified operator for which the operator is certified.

(2) Certified operators shall be recertified every five (5) years.

(3) Certificates will be issued to holders of certificates of another state if the training requirements of the issuing state are deemed comparable as specified in Section 7(6) of this administrative regulation and if the operator passes the cabinet's examination.

(4) The certificates of operators who terminate their employment at a solid waste site or facility will remain valid until expiration or revocation of the certificate.

(5) Certificates shall be carried on the person of each certified operator during working hours at the facility or prominently displayed on site.

Section 9. Compliance Dates. (1) An operator who is not an appropriately certified operator and who assumes the responsibility of a certified operator shall immediately comply with the requirements in Section 12 of this administrative regulation; and

(2) Comply with the requirements in Section 6 of this administrative regulation within fifteen (15) months of assuming the responsibility.

Section 10. Revocation of Certificate. (1) The cabinet may revoke the certificate of an operator, following a cabinet hearing, when it determines that the operator has practiced fraud or deception, or that the operator has failed to perform an operator's duties including, but not limited to, failure to comply with permit conditions.

(2) The cabinet may revoke a certificate whenever the holder fails to use reasonable care and judgment in the performance of an operator's duties. No certificate shall be valid if obtained through fraud, deceit, or the submission of inaccurate data on qualifications.

(3) Individuals who have had their certificate revoked by the cabinet shall be ineligible for future recertification.

Section 11. Operator Qualifications: Education and Equivalencies. (1) All applicants shall be evaluated by the cabinet as to education, and experience as related to the appropriate category of solid waste site or facility.

(2)(a) Applicants for landfill operator shall have completed high school (by graduation or by obtaining an equivalency certificate) and shall have a minimum of one (1) year of experience at a landfill similar to the category of landfill for which certification is sought.

(b) If an applicant for landfill operator does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the number of years of experience in operating a landfill or experience in a related field (i.e., heavy equipment operator, road construction, surface mining, etc.) in determining eligibility for examination on a year-for-year basis.

(3)(a) Applicants for landfill manager shall have completed high school (by graduation or by obtaining an equivalency certificate) and shall have:

1. A minimum of two (2) years administrative experience in a related field (i.e., waste management, wastewater treatment, etc.); or

2. A minimum of two (2) years of postsecondary education; or

3. A minimum of two (2) years of a combination of experience in a related field and postsecondary education.

(b) If an applicant for landfill manager does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the qualifications of the applicant on a case-by-case basis.

(4)(a) Applicants for landfarming operator shall have completed high school (by graduation or by obtaining an equivalency certificate) and shall have a minimum of one (1) year of experience at a landfarming facility.

(b) If an applicant for landfarming operator does not meet the requirements of paragraph (a) of this subsection, the cabinet may consider the number of years of experience in operating a landfarming facility or experience in a related field (i.e., waste water treatment, water treatment, etc.) in determining eligibility for examination on a year for year basis.

Section 12. Interim Operators. (1) In accordance with the requirements in subsection (2) of this section, the permittee shall notify the cabinet in writing of the extended absence of a certified operator ten (10) days prior to an anticipated absence and immediately upon discovery of an extended absence due to an emergency or unanticipated circumstances. The notice from the permittee shall provide the cabinet with the following information:

(a) Name and qualifications of the individual intended to replace the certified operator; and

(b) The length of time for which the permittee seeks to have the interim operator fulfill the obligations of the certified operator.

(2) The permittee shall notify the cabinet of the extended absence when the operator or manager shall be absent for:

(a) More than ten (10) consecutive operating days for a landfill operator;

(b) More than thirty (30) consecutive operating days for a landfill manager; and

(c) More than five (5) consecutive operating days for a landfarming operator.

(3) Consecutive operating days as used in subsection (2) of this section shall be determined as any days:

(a) When the solid waste site or facility accepts waste, operates equipment or otherwise performs the business of solid waste management; and

(b) Which days occur in sequence regardless of whether nonoperating days such as weekends or holidays fall in between.

(4) The cabinet shall evaluate the qualifications of the designated interim operator and shall notify the permittee of the cabinet's determination in writing within thirty (30) days of receipt of the permittee's notice. The determination shall:

(a) Approve or deny the permittee's request for designation of the interim operator;

(b) Identify the length of time the interim operator may operate the solid waste site or facility; and

(c) Specify conditions as appropriate to the site and the interim operator's qualifications.

Section 13. Permit Condition. As specified in Section 2 of this administrative regulation, every solid waste site or facility requiring a permit shall be operated by the operator certified pursuant to this administrative regulation. Pursuant to Sections 2 and 3 of this administrative regulation, maintaining the certified operator(s) shall be considered a permit condition, and the permit may be revoked, or penalties for permit violations sought as appropriate, upon violation of the requirements and duties established by this administrative regulation.

Section 14. Fees. (1) Fees for application for certification shall be:

(a) $125 for application for certification as a landfill operator;

(b) $125 for application for certification as a landfill manager;

(c) $150 for application for certification as both a landfill operator and a landfill manager when the application is made for certification for both categories at the same training session;

(d) $125 for application for certification as a landfarming operator; and

(e) Fifty (50) dollars for certification by reciprocity for all categories of operator.

(2) Fees shall accompany applications and will not be returned to those who do not qualify for a certificate. (Recodified from 401 KAR 2:111, 3-1-83; Am. 10 Ky.R. 172; eff. 12-2-83; 13 Ky.R. 913; 1228; eff. 1-13-87; 16 Ky.R. 1642; 2174; eff. 5-8-90.)

APPENDIX D

CONTACTS

CONTACTS BY TOPIC

The Division of Compliance Assistance is now responsible for the implementation of the landfarm certification. The Division of Waste Management is still responsible for the permits, annual review and reporting requirements. The information below offers the reader a contact person for various areas of assistance.

Division of Compliance Assistance

Phone Number: 502-564-0323 or 800-926-8111 *Fax Number: 502-564-9720*

• Certification (training, testing & fees)	Lisa Butler
• Compliance Assistance	Kenya Stump
• Open records requests related to certification	Julia Kays
• Regulations related to certification	Julia Kays

Division of Waste Management

Phone Number: 502-564-6716 *Fax Number: 502-564-3492*

• Technical assistance on permits	Ron Gruzesky
• Landfarm & Compost	Bob Bickner
• Annual review assistance	Frank Whitney Robin Green
• Solid Waste Landfills	Ron Gruzesky Lindsey Briggs Ken Melton
• Forms and fees not related to certification; Bonding and reporting requirements	LeMoyne Pilcher Anita Young Stephen Kempf John Arnett Deborah DeLong
• Open records requests related to facilities	Tina Fisher
• Regulations related to facility requirements	Cassandra Jobe
• Complaints	Duke York
• Facility inspections	Jon Maybriar
• Enforcement	Jeff Cummins (502-564-2150)

DWM Field Offices

Field Offices	Phone Number	Office Supervisor
Bowling Green	270-746-7475	Todd Johnston
Columbia	270-384-4735	John Rogers
Florence	859-525-4923	Michael Fant
Frankfort	502-564-3358	Richard Thomas
Hazard	606-435-6022	Greg Eldridge
London	606-330-2080	Bill Belcher
Louisville	502-429-7120	Keith Sims
Madisonville	270-824-7532	Larry Tichenor
Morehead	606-784-6634	Karen Hall
Paducah	270-898-8468	Marjorie Williams